# THREE ESSAYS ON HEALTH CARE UTILIZATION, GOVERNANCE AND PROVIDER REIMBURSEMENT IN URBAN CHINA

by

**Wei Wang**

M.A. in International Economics, Shanghai Academy of Social Sciences, 2000

B.S. in International Finance, Shanghai Jiaotong University, 1997

Submitted to the Graduate Faculty of

the Arts and Sciences in partial fulfillment

of the requirements for the degree of

**Doctor of Philosophy**

University of Pittsburgh

2009

UNIVERSITY OF PITTSBURGH

DEPARTMENT OF ECONOMICS

This dissertation was presented

by

Wei Wang

It was defended on

August 18, 2009

and approved by

Thomas Rawski, Professor, Department of Economics, University of Pittsburgh

Siddharth Chandra, Professor, Graduate School of Public and International Affairs, University of Pittsburgh

Alexis León, Assistant Professor, Department of Economics, University of Pittsburgh

Soiliou Namoro, Assistant Professor, Department of Economics, University of Pittsburgh

Shanti Gamper-Rabindran, Assistant Professor, Graduate School of Public and International Affairs, University of Pittsburgh

Dissertation Director: Thomas Rawski, Professor, Department of Economics, University of Pittsburgh

# THREE ESSAYS ON HEALTH CARE UTILIZATION, GOVERNANCE AND PROVIDER REIMBURSEMENT IN URBAN CHINA

Wei Wang, PhD

University of Pittsburgh, 2009

The first essay uses a model of profit-maximizing hospitals to examine hospital responses to global budgeting in the forms of dumping and cost shifting. The main findings include: (1) Hospitals dump insured patients when the covered services are priced under costs. Whether the budget target is binding depends on its size relative to the mandated fees and production costs of insured services. (2) Only when hospitals operate at full capacity and the uninsured patients have inelastic demand do providers shift costs to the uninsured. (3) When revenue shocks dominate, cost shifting lowers the income from the insured while increasing that from the uninsured patients. When cost shocks dominate, incomes from the two groups may be positively correlated.

In the second essay, I use insurance claim data in a difference-in-differences model to empirically investigate the effects of global budgeting on providers' selection and skimping against high-cost patients in China. It finds that non-last resort (LR) hospitals respond to global budgeting by avoiding unprofitable patients as well as selectively reducing the intensity of their treatment. Interestingly, I did not find evidence of skimping for LR providers. This indicates that non-LR hospitals achieve at least part of the adverse selection by making services inadequate for high-cost patients.

In the third essay,[1] we use survey data in an endogenous switching regression model to

[1]This is essay is co-authored with Gordon Liu at Guanghua School of Management, Peking University, China

analyze the price gap between state and private hospitals in China. Our analysis finds strong evidence that outpatient care is not only much more expensive at the public sector, but more expensive to a greater extent for certain disadvantaged social groups than for the general population. We explain this finding by noting that the private sector can price discriminate with greater flexibility than the tightly regulated public sector. We also find that the bigger the share of physicians working in the private sector, the lower the public-private price gap as well as the overall average price. These results indicate that increasing competition in the market for physicians may significantly lower the price of health care by enabling private providers to enhance their reputation through attracting well-trained physicians.

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## PREFACE

I wish to express a deepest feeling of gratitude to my principal academic advisor, Professor Thomas Rawski. Throughout the course of my doctoral study, he has offered me his guidance and encouragement in the most generous manner. His breadth of knowledge and level of scholastic achievement has given me constant inspiration, while, when my research is at its ebbs, his understanding and tireless help has enabled me to obtain key breakthroughs. I consider myself truly fortunate to have been his student, and wish only to do justice to his trust by living up to his expectations.

My Committee Members, Professors Siddharth Chandra, Alexis León, Soiliou Namoro and Shanti Gamper-Rabindran patiently examined my work and provided me with the most insightful advice. Their comments and challenges are invaluable in increasing the quality of my research and in helping me explore new directions.

I am grateful to my coauthor, Professor Gordon Liu at Peking University, for his patience, motivation and contributions. The nineteen months I spent at the research center under his direction was profoundly important for my academic development. I have benefited substantially from his mentoring and his help with my career.

I wish to thank the staff members of the Economics Department, in particular Ms. Amy Linn, Lauree Graham and Debbie Ziolkowski, who have on more than one occasion gone out of their way to help me through my administrative duties.

I dedicate this dissertation and my Ph.D. degree to my parents. My late father will be forever in my memories. His tender affection, which constantly betrayed itself despite his stern appearance, has touched my life in the most profound way. My mother, with her

boundless love, patience and perseverance, is among the principal forces that have made the completion of my Ph.D. studies possible.

# 1.0 INTRODUCTION

## 1.1 CHINA'S HEALTH CARE SYSTEM

China's market-oriented reforms have brought fascinating changes to its health care sector in the past three decades. As in many other parts of the economy, decentralization and incentivization have significantly altered the delivery and financing systems of health care. The publicly owned hospital sector has obtained a substantial amount of financial autonomy from the government. Moreover, reforms of the state economic sector have left the financing of health care a largely personal responsibility. It has been argued that, within the span of 20 years, China's health system has transformed into the world's most market-oriented system [Wagstaff *et al.* (2009b)[119]].

In many other ways, the government still holds considerable control over the health sector. It regulates the pricing of medical services, sets entry rules for the hospital care market, many of which may restrict the development of the private health sector, and influences market outcomes through regulating the massive state delivery system. Therefore, the Chinese health care system is characterized by a mixture of market and regulatory incentives.

This mixture of incentives has created or even aggravated a number of problems in China. Before 2003, economic liberalization reduced the coverage and generosity of health insurance as the foundation of the publicly financed insurance system decayed.[1] Not surprisingly, the

[1]According to the third national health services survey, the share of insured population in urban areas dropped from over 70% in the early 1990s to below 60% in 2003. The problem was much more severe in rural areas, where 80% of the residents did not have any kind of insurance.

share of out-of-pocket (OOP) financing in health spending rose substantially,[2] resulting in high rates of catastrophic expenses or even impoverishment.[3]

While financial protection from the health system weakened, the cost of health care grew rapidly, fueled in part by perverse provider incentives. For public hospitals, financial autonomy made the pursuit of economic returns a top priority on both the institutional and the individual levels. As a result, providers responded readily to monetary incentives, in particular the incentive embedded in the regulated fee schedule, where preventive and basic services were priced below cost while drugs and diagnostic tests were priced at positive margins. This created substantial bias toward prescribing costly services at the expense of basic cost-effective care.[4]

The pattern of government health spending probably made matters worse. While it grew in real terms from 1995 to 2003, government health spending in China was definitely pro-rich by international standards [van Doorslaer *et al.* (2007)[114]]. In particular, it allocated over 40% of its resources as demand-side subsidies to the urban health insurance system that covered disproportionately the socially advantaged. Its supply-side subsidies were also biased toward the better-off by favoring urban hospitals [Ministry of Health (2004)[89]]. Finally, there were wide regional disparities in public health spending as local governments at the provincial or county level assumed increased roles in health care financing [Wagstaff *et al.* (2009a)[118]].

As a result of the above problems, China's health care system before 2003 was characterized by high incidence of catastrophic OOP expenses, escalating cost,[5] reduced access to

[2]The OOP share almost tripled from 21.5% in 1980 to 60% by 2001. Since then, there has been a trend of steady decline, thanks largely to the creation of two social insurance systems in the urban and rural areas.

[3]Van Doorslaer *et al.* (2006)[115] found that, in 2000, OOP expenditure raised the dollar-a-day poverty head count in China by 19%. In a later study, van Doorslaer *et al.* (2007)[114] found that the share of the population experiencing "catastrophic" health expenses, defined as more than 25% or 40% of household non-food consumption, was higher in China than elsewhere in Asia in 2000.

[4]China has one of the world's highest shares of drug costs in total health spending, standing at 54.7% and 44.7% of outpatient and inpatient expenditure in 2003, respectively. By contrast, the average in the OECD countries is about 15% [Ministry of Health (2004)][89]]. In addition, the World Bank estimated that 16% of China's CT scanners were unnecessary. As a another example, the rate of caesarian sections in birth deliveries increased from 20% in the 1980s to about 50% in two decades, far exceeding the WHO's recommended level of 15% [Development Research Center, State Council (2005)[19]].

[5]Inflation-adjusted per-episode outpatient cost grew by 13.29% per annum between 1996 and 2003. The

health care,[6] socioeconomic and geographic inequalities, and declines in improvements of the population health level.[7]

## 1.2 RECENT HEALTH SYSTEM REFORMS

In answer to the challenges to its health care system, China has started a series of ambitious reform measures since the beginning of the new millennium. The priority of the recent reforms is to expand the spread of health insurance among the population.

In 1998, a national campaign was initiated to merge the existing publicly financed insurance programs into a city-level system that provided coverage for urban residents with stable employment.[8] Called the urban basic medical insurance (BMI) system, the program has the following characteristics: mandatory enrolment, employer and employee premium contributions proportional to individual incomes, and mixed use of individual savings accounts and risk-pooling funds. While a typical benefit package includes a number of demand-side cost-sharing measures, such as deductibles and drug/service formularies, reforms of the provider payment method remain in the discretion of local health authorities [Liu (2002)[79]].[9]

Almost a decade after its launch, enrollment in the BMI program expanded to 30% of the urban population as of 2007. Then in July of the same year, the central government announced its plan to introduce a similar program for the 420 million urban residents not ineligible for BMI. The target groups include children, the elderly, the unemployed and

same growth pattern was observed for inpatient expenditure. In contrast, the annual growth rate of real income during the same period was 8.9% and 2.5% in urban and rural areas, respectively, while the consumer price index increased by 1.25% per annum [Ministry of Health (2004)[89]].

[6]The third national health services survey reported that, in 2003, 48.9% of the respondents failed to receive care against their medical needs, up from 38.5% in 1998.

[7]Several key health indicators, including life expectancy, infant mortality and under-five mortality rates, have experienced a "regression to the mean." While well above the level expected of a country with low per capita income before the reform era, these health measures have regressed to the world average by 2000, despite rapid economic growth [Wang (2003)[121], Eggleston *et al.* (2008b)[36]].

[8]The national campaign was started following pilot experiments in two medium-sized cities, Zhenjiang of Jiangsu Province and Jiujiang of Jiangxi Province.

[9]By custom, providers are paid on the fee-for-service basis.

individuals without stable employment. Unlike the employee BMI, the new program enrols households on a voluntary basis. In 2007, pilot experiments were started in 79 localities. According to the official schedule, coverage would expand to 100% of the target population by 2010. Preliminary evidence suggests that 40.68 million individuals had joined the program as of July 2008 [Cheng (2008)[15]].

Substantial efforts have also been made to fill the vacuum of health insurance coverage in rural areas. In 2003, roll-out of a program called the new cooperative medical system (NCMS) began in selected rural counties. Its purpose was to provide farmers with risk pooling of health care expenses at the county level. In most areas, participation is voluntary. Despite generous demand-side subsidies from the central and local governments, the level of financing for the program is low, especially in poor areas. A member household usually faces high deductibles and copayment rates as well as low reimbursement ceilings. According to statistics released by the Ministry of Health, NCMS coverage had spread to 91.5% of China's rural population by April 2009. Existing studies of its impact find that, although NCMS has improved access to health care among the participants, it does not have significant effects on household OOP expenses or health status [e.g., Lei & Lin (2009)[68], You & Kobayashi (2009)[138]].

## 1.3 OBJECTIVES OF THE DISSERTATION

One element that has taken a less prominent position in the recent wave of reforms in China is orchestrated effort to improve provider incentives through payment or competitive measures. Experimentation with different provider payment methods has remained local initiatives. As for the role of the market in health service delivery, a recent government report pledges full financial support for low-level, basic-care facilities, in particular community health centers, in the case of which the scope of the market is expected to be considerably curtailed.[10]

[10]The State Council report, published in January 2009, some three years after the project started, was synthesized from the studies by a group of academics, international organizations and management consul-

Nevertheless, the report offers no prescription for higher-level providers.

In contrast to the lack of policy decision is the substantial attention these issues have received in studies of health system reforms. In particular, the role of payment methods in influencing provider behavior is much examined in the literature. While confirming the general conclusions, recent research on China's scattered payment reforms has deepened our knowledge of payment incentives.[11] However, since evidence of China's payment reforms has emerged only in recent years, the small number of studies available has left many an important question unanswered.

The literature on the impacts of provider ownership and market competition, on the other hand, is far from conclusive. Theoretical analyses originating from different assumptions or empirical studies using different data sets have reached diametrically opposite conclusions [e.g., Sloan (2000)[108], Kessler & McClellan (2000)[66]]. The limited evidence from China does not shed much light on the puzzle either.[12]

Against this backdrop, my dissertation undertakes a rigorous examination of the issues of payment incentives, provider ownership and market liberalization in the context of China's urban health care sector. It also relates the Chinese experience to our knowledge of international health systems. In particular, I ask the following questions: Does the global budget policy, a payment method that sees increasing use in China's BMI system, induce providers to avoid high-cost patients or to skimp on their treatment? What are the circumstances under which hospitals respond to global budgeting by shifting costs to uninsured patients? How does the dominant state health sector perform relative to the rapidly growing private sector? Can market liberalization succeed in lowering the overall price of medical services in urban China? Throughout the dissertation, I aspire to answer these questions in a manner that will be useful for both academic health economists and China's policy makers.

---

tants. According to the government of China, this report marks the beginning of the most comprehensive health system reform to date. Apart from subsidizing low-level providers, the other measure for ensuring access to affordable basic care is the expansion of health insurance coverage.

[11] For instance, Liu and Mills (2003)[78] found that individual bonus systems increased hospital revenues and the volume of profitable services. Studying the use of global budgeting in Hainan Province, Eggleston and Yip (2001[33], 2004[34]) concluded that prepayment policies had exactly the opposite effects.

[12] In this light, the lack of action in the recent policy document is perhaps not surprising.

## 1.4 CONTENTS OF THE DISSERTATION

The dissertation consists of three chapters. The first chapter, "*Hospital Responses to the Global Budget Policy: The Cases of Patient Dumping and Cost Shifting*," uses a model of profit-maximizing hospitals to examine the circumstances under which global budgeting induces providers to avoid insured patients or to raise charges to uninsured patients. It incorporates the fee regulation in China's health care system by defining cost shifting as an increase in the total provider charges for a given episode in response to rising cost-saving pressure from the global budget policy. With a resource constraint, my model removes the inconsistency between profit maximization and cost shifting usually found in the theoretical literature. The main findings include: (1) Hospitals dump insured patients when most of the covered services are priced under their costs. Whether the budget target is binding for a hospital depends on its size relative to the mandated fees and production costs of the services. (2) Only when hospitals operate at full capacity and the uninsured patients have inelastic demand do providers shift costs to the uninsured. The degree of cost shifting varies with the correlation between official fees and actual costs, the share of insured patients in the hospital's total volume, and the competition level of the market of hospital services. (3) If the conditions of full capacity and inelastic demand are not satisfied, hospitals respond to global budgeting by lowering charges to increase the volume of uninsured patients. (4) When revenue shocks dominate, cost shifting lowers the income from the insured while increasing that from the uninsured patients. When cost shocks dominate, incomes from the two groups may be positively correlated.

In the second chapter, titled "*How do High-Cost Patients Fare under the Global Budget Policy? — Evidence from China*," I use insurance claim data from the BMI program of Zhenjiang to investigate the discriminatory effects of the global budget policy. The study uses as a natural experiment an amendment of the global budget system that relaxed the cost-saving pressure on hospitals. In particular, it exploits the varying impact of the policy change on different patient groups in a difference-in-differences model. It finds that, fol-

lowing the amendment, high-cost patients were less likely to be pushed to a "provider of last resort" than before. This suggests that, before the policy change, non-last resort (LR) providers responded to global budgeting by avoiding unprofitable patients. In addition, non-LR hospitals selectively increased the intensity of services delivered to costly patients after the amendment. Interestingly, I did not find evidence of skimping for LR providers. This finding indicates that non-LR hospitals achieved at least part of the adverse selection by making services inadequate for high-cost patients. The results are robust to sensitivity analyses on a different control group.

In the third chapter, "*The Role of Private Providers in Lowering the Cost of Health Care: Evidence from Urban China*" (co-authored with Gordon Liu[13]), we use World Bank survey data in an endogenous switching regression model to analyze the price gap between state and private hospitals. We also investigate the impact of expanding the private sector upon the price of health care. As in the first chapter, we account for fee regulation by defining "price" as the total provider charge for a hospital visit. Our analysis finds strong evidence that outpatient care is not only much more expensive at the public sector, but more expensive to a greater extent for certain disadvantaged social groups than for the general population. We explain this finding by noting that the private sector can price discriminate with greater flexibility than the tightly regulated public sector. We also find that the bigger the share of physicians working in the private sector, the lower the public-private price gap as well as the overall average price. These results indicate that the combination of state market control and insufficient information on health care quality has hindered price competition in China's hospital sector. As a viable remedy, increasing competition in the market for physicians may significantly lower the price of health care by enabling private providers to enhance their reputation through attracting well-trained physicians.

[13]Guanghua School of Management, Peking University, China

## 1.5 CONTRIBUTIONS OF THE DISSERTATION

As China moves toward the goal of universal coverage, orchestrated changes to the provider payment method and the structure of the health care market will appear high on the reform agenda. Therefore, fuller knowledge of the effects of supply-side measures will become necessary. With its rigorous examination of these issues, my dissertation contributes to the knowledge base that will inform the next stage of health system reforms in China.

Moreover, the problems China faces clearly have an international echo. Some of them relate directly to health care issues typical of transitional economies, while others address general health policy concerns. Studying these problems in China is not only interesting in itself, for their impact on the largest population in the world, but will also generate useful policy insights that are of relevance for many other countries.

For transitional economies, an important issue is defining the boundary between the state and the market in health care delivery. The health systems of most of these countries are characterized by dominance of state ownership of health delivery organizations. As has China, many have reformed their delivery systems with liberalization and incentivization measures. My study of the pricing behavior of public *vs.* private providers in China will help determine the role of the market in such environments where both financial and regulatory incentives are at play. In terms of general policy concerns, the issue of provider payment methods has received considerable attention in the literature. My papers on the global budget policy will help suggest ways to improve this method so as to induce proper provider incentives with respect to two vulnerable patient groups: the high-cost and the uninsured.

Specifically, my dissertation makes the following contributions:

The first chapter studies the dumping and cost-shifting behavior of a profit-maximizing hospital. It departs from the literature by defining cost shifting as an increase in the *total* provider charge to the uninsured for a given medical contact (e.g., charges per outpatient visit or hospital admission) following an exogenous change in the payment rules. As such, cost shifting is not so much simple pricing behavior as a decision of resource allocation

among different patient groups. With a resource constraint, this specification removes the analytical inconsistency between profit maximization and cost shifting that is usually seen in the literature.

The second chapter of my dissertation is the first study on the discriminatory effects of the global budget policy. Although patient discrimination is well analyzed in the context of the prospective payment systems in the U.S., similar evidence for the global budget policy is extremely rare. In addition, much of the literature on global budgeting is either theoretical or descriptive in nature. It has yet to produce empirical evidence of a comparable quality and influence to those on other payment methods. My study aims to fill these gaps by providing rigorous evidence of the discriminatory effects global budgeting may create for the group of high-cost patients. Moreover, it examines a particular type of global budget that creates very different provider incentives from the one most frequently used in OECD countries. Comparing the outcomes of these variants will produce insights that are of interest to the policy-makers in both systems.

Finally, the third chapter takes an important step toward assessing the benefits of market liberalization for China's health delivery system. Although a vast literature has developed to identify the effects of provider ownership and market competition, it focuses heavily on developed countries, especially the US. Evidence from developing and transitional economies is in short supply. This study aims to alleviate this shortage by investigating these two issues in the context of China. Apart from their contributions to the literature, our results will inform the health care reforms in other developing and transitional economies, with whom the Chinese health system shares many salient features.

# 2.0 HOSPITAL RESPONSES TO THE GLOBAL BUDGET POLICY: THE CASES OF PATIENT DUMPING AND COST SHIFTING

## 2.1 INTRODUCTION

This paper examines hospital responses to the recent provider payment reform in urban China and their impact on access to care for patients insured by the public insurance program as well as the uninsured. It investigates two questions: (1) As the reform changes the payment method from fee-for-service (FFS) to global budgeting, do hospitals reduce expenditure by refusing treatment to insured patients whose care becomes less profitable than before the reform (i.e., patient dumping)? Second, do they attempt to recover the lost income by raising charges to uninsured patients (i.e., cost shifting)?

The study is set against the backdrop of the public health insurance system of urban China. To curb cost escalation, health insurance administrators throughout the country have adopted measures aimed at altering the system incentives. Along with a set of managed care instruments, such as provider contracting and drug formularies, payment reforms have been implemented in many areas, moving away from FFS to some form of negotiated prepayment.

The prepayment method most frequently used is fixed budget because of its ease of implementation. Compared to FFS, global budgeting lowers the return to providing services beyond the expenditure cap. The heightened financial pressure may create adverse changes in provider behavior. In particular, a provider may refuse treatment to insured patients or reduce the quality of their care. It may also cross-subsidize the lost revenue by shifting costs to services or patients not covered by prepayment. If global budgeting induces hospitals to

dump patients of certain characteristics or to make medical care more expensive for others, the goal of cost containment is achieved only at the expense of reduced access.

This paper studies hospital responses to the payment reform. It departs from the literature in its definition of cost-shifting. To address the institutional characteristic of China's health care system where the fees of individual services are subject to government regulation, the paper defines cost-shifting as the increase in per episode *charges*, rather than in fees for single services, to one patient group as a provider attempts to recover the income lost on another. Dumping is defined as a decrease in the load of insured patients below an exogenous "normal" level. Based on these definitions, the paper develops a model of profit maximizing hospitals that predicts both patient dumping and cost shifting. Unlike many studies in the literature [e.g., Hay (1983)[53], Foster (1985)[43]], it shows that, when global budgeting is used as a payment method, cost shifting is consistent with the paradigm of profit maximization under certain conditions.

The main findings of the paper are as follows: (1) Hospitals dump insured patients when most of the covered services are priced under their costs. Whether the budget target is binding for a hospital depends on its size relative to the mandated fees and production costs of the services. (2) Only when hospitals operate at full capacity and the uninsured patients have inelastic demand do providers shift costs to the uninsured. The degree of cost shifting varies with the correlation between official fees and actual costs, the share of insured patients in the hospital's total volume, and the competition level of the market of hospital services. (3) If the conditions of full capacity and inelastic demand are not satisfied, hospitals respond to global budgeting by lowering charges to increase the volume of uninsured patients. (4) When revenue shocks dominate, cost shifting lowers the income from the insured while increasing that from the uninsured patients. When cost shocks dominate, incomes from the two groups may be positively correlated.

These findings have both theoretical and policy implications. The paper is the first study that relates global budgeting with patient dumping and cost shifting. Its predictions will help develop empirical strategies to identify the existence of cost shifting, which remains a

controversial issue in the literature.

In addition, the results can be used to evaluate the welfare consequences of global budgeting in China. As in many public insurance systems, interest has been rising in China in effective supply-side cost control measures. However, there have been few studies on provider responses to the payment changes. This paper indicates that these responses will determine the real outcomes of the reforms. If hospitals dump insured patients, access among this group will decline, especially for those with severe conditions. Furthermore, cost shifting will compromise the goal of cost containment as prepayment will have little effect on total expenditure if the hospitals are able to increase the charges to uninsured patients. More importantly, subsidizing care for the insured with revenues from the uninsured will deepen the inequity in the distribution of medical resources in China. Access to affordable care will continue to be a major difficulty for a large number of urban citizens.

The rest of the chapter is organized as follows. Section 2.2 describes the institutional characteristics of China's health care system and the recent reforms. Section 2.3 reviews the literature on cost shifting. Section 2.4 develops the model and its predictions. Finally, Section 2.5 concludes.

## 2.2 BACKGROUND: DELIVERING AND FINANCING HEALTH CARE IN URBAN CHINA

### 2.2.1 Delivery: A Changing Paradigm

State-owned hospitals are the predominant health care providers in urban China.[1] They are organized along a three-tiered system, consisting of street health stations (the first level), district health centers (the second level) and municipal hospitals (the third level), with increasing degrees of capacity and technological sophistication [Hsiao (1995)[59]]. In this

[1] In 2003, they employed 62.5% of the nation's licensed physicians and 72.2% of the hospital beds [Ministry of Health (2004)[89]]. In 2002, over 2/3 of China's health expenditure was spent on hospital services [*China Health Yearbook* Editorial Board (2004)[16]].

system, the pattern of health care provision has considerably changed since the early 1980s. The locus of care has shifted from lower-level facilities to large and tertiary hospitals[2] and from preventive or basic care to invasive curative services. Furthermore, there has been a proliferation of advanced medical technologies.[3] As a result of these changes, health care in China has become costlier than it was a decade ago.[4]

The transition to a more expensive style of health care in China has been attributed to various factors, including growing income and higher expectations of the quality of life [Bloom (2002)[10]], aging and increasing prevalence of chronic diseases[5], and provider incentives [Development Research Center, State Council (2005)[19], Liu *et al.* (2003)[75]]. Studies using data from before the 1990s found that natural factors, such as aging of the covered population, accounted for 80% of the increase in health spending [e.g., Liu & Hsiao (1995)[76]]. Although there have been few similar studies using more recent data, the literature generally agrees that the role of provider behavior in cost inflation has become much more important in the past two decades.

The most important influence on provider behavior is an increasing degree of financial autonomy. In the mid-1980s, reforms aimed at decentralizing management at health care facilities limited state subsidy for public hospitals to only 10% of their revenue, covering basic wages and capital investment. Hospitals rely on user charges for the bulk of their income. Furthermore, they have full discretion over the distribution of revenue surplus [Dong (2001)[22]].

Studies of China's health care system contend that the combination of financial autonomy

[2]According to the second national health service survey, 67% of the patients in the sampled areas sought care from municipal or higher-level hospitals in 1997 [Statistics and Information Center, Ministry of Health (2004)[88]].

[3]Consumption of drugs, especially expensive brand-names, comprises the largest component in the country's total health expenditure. The share of drug spending in total health expenditure was 50% in 1990 and decreased slightly to 46% by 2000 [Development Research Center, State Council (2005)[19]]. Moreover, half of the municipal and higher level hospitals owned a CT scanner in the late 1990s [Ministry of Health (2000)[89]].

[4]From 1989 to 2001, growths in the costs per outpatient visit and per hospital day were almost twice the increase in per capita income in urban areas [Wang (2003)[121]].

[5]Life expectancy at birth rose from 67.9 to 71.4 between the 3th (1981) and the 5th (2000) national census [*China Health Yearbook* Editorial Board (2004)[16]]. Meanwhile, the ratio of pensioners to workers increased from 1:12.8 to 1:4.8 from 1981 to 1995 [West (1999)[124]].

and decreased public funding has given the hospitals a strong incentive to pursue profit [Liu & Hsiao (1995)[76], Liu *et al.* (2000)[77], Liu (2005)[**?**]]. A striking illustration of the profit objective is the powerful impact of pricing structure on prescription behavior. In China, service fees within the public sector are subject to government regulation.[6] To provide implicit insurance for the indigent, the government of China prices basic, non-invasive services at below their cost, while allowing hospitals to cross-subsidize their income by charging mark-ups on other services, such as imported drugs and high-tech diagnostic tests. As a result, prescription is strongly biased toward these profitable services. Table 2.1 shows the structure of the average expenditure per outpatient visit and per hospital admission, respectively, in selected years between 1990 and 2003. Drug spending alone constituted over 50% of the average spending on outpatient services and 40% of inpatient expenses. Although it has been decreasing in the last decade, the share of drug expenditure in total health spending in China is still much higher than in the developed countries [World Bank (2005)[132]].

Another illustration of the financial incentive is the responsibility system introduced in the compensation for physicians in the 1980s. Under this system, bonuses are rewarded to physicians whose service volume reaches or exceeds the quota set by the hospital administration. This form of fee-splitting remains a tool widely used by urban hospitals to stimulate their medical staff to generate revenue.

### 2.2.2 Financing: Incomplete Coverage

The backbones of the health insurance system in urban China are city-wide Basic Medical Insurance (BMI) programs that cover urban workers with stable employment. Although the system has been expanding since its inception in 1998, it has yet to achieve universal coverage. In particular, enrolment rate is low amid three low-income groups: employees of money-losing enterprises, the self-employed and temporary migrants from rural areas.[7]

[6]The fees of private for-profit providers are not under regulation, while private non-profit facilities can charge within a wide region around the official fee schedule.

[7]According to the third national health service survey, 12.2% of urban residents in the lowest income stratum were covered by social insurance in 2003, compared to 70.3% in the richest group.

Furthermore, some employers with young and healthy work forces have resisted joining.[8] The varied participation rate among population groups creates scope for cost shifting, though the segment of the uninsured is heterogenous in terms of income and social status.

Various BMI programs have introduced payment reforms to contain providers' prescription behavior, moving away from FFS to prepayment [Cai *et al.* (2000)[12], Eggleston & Yip (2001)[33]]. So far, the prepayment method most frequently used is global budgeting. In Shanghai and Zhenjiang, for instance, hospitals are given an annual expenditure quota for all the covered services. They absorb part of the expenses in excess of the quota. If the quota is not reached, the actual expenditure is reimbursed [Shanghai Health Insurance Bureau (2002)[107], Zhenjiang Social Security Bureau (2000)[141]].

Another key characteristic of the BMI system is free patient choice of providers. It has profoundly influenced the structure of the health care market in China. In particular, patients, who may not have sufficient information to judge the quality of care, usually favor large tertiary-level hospitals for their reputed quality and market status [Eggleston *et al.* (2008a)[35]]. The faith in large hospitals has created considerable pressure on their capacity, contributing to the overuse of these facilities. Lower-level providers, on the other hand, have seen significant reductions in their patient load since the launch of the BMI system.

## 2.3 LITERATURE REVIEW

### 2.3.1 Cost Shifting

Research on cost shifting in the US was driven by the claim of private insurers that Medicare and Medicaid payment cuts had forced hospitals to raise charges to privately insured patients. Based on this allegation, private insurers argued that all-payer rate setting would lead to more equitable payment rates among all payers [HIAA (1982)[57], Zuckerman (1987)[144]].

[8] In Shanghai, for instance, foreign-invested companies and enterprises affiliated with the central government or the Ministries of Mining and Railways refused to participate in the local BMI program.

The literature regards cost shifting as the consequence of "underpayment" by public insurance programs. Two definitions of underpayment are frequently seen. Hay (1983)[53] holds that cost shifting occurs only when government programs pay less than the average cost, while private payers pay more. Alternatively, Sloan and Becker (1984)[109] define cost shifting as an increase in the price applied to one payer group because it is lowered for another. Both definitions are appealing in some ways. Hay centers on the impact of lowered payments on the financial viability of a hospital, emphasizing the *need* to cost shift. The definition by Sloan and Becker, on the other hand, stresses the *dynamics* of provider behavior and the welfare implications of cost shifting.[9]

The literature has produced considerable controversy over the existence of cost shifting. Feldstein (1993)[42] argued that profit-maximizing hospitals do not shift costs in the Sloan-Becker sense since, under profit maximization, prices would already be optimal. Foster (1985)[43] studied a model where the profit-maximizing hospital faces a (de)marketing cost as it tries to attract or dump government patients. He showed that cost shifting could not take place if the production technology created economies of scale. In this case, private patients would actually benefit from government fee reductions since the hospital would lower private prices. Cost shifting is thus inconsistent with the assumption of profit maximization.

Empirical studies have yet to create unambiguous results to settle the debate.[10] Hadley and Feder (1985)[50] analyzed non-maximizing hospitals that may increase the price to private paying patients as a survival strategy when their revenues are squeezed. Financial pressure may arise from not only government payment cuts, but also other activities such as provision of charity care. Using data from a national sample of private hospitals in 1980 and

[9]Cost shifting in the dynamic sense is different from price discrimination. To shift costs, the hospital must raise prices to one set of patients in response to lower prices from another [Morrisey (1996)[91]]. Two conditions must be satisfied. First, the hospital must have market power, being able to increase prices without driving patients away. Second, it must not have been fully exercising the market power by maximizing profit, since a profit maximizing hospital would already have chosen the optimal prices [Feldstein (1993)[42]].

[10]This paper cites only studies using the dynamic approach. This approach seeks to examine the change in some measure of private prices in response to a change in government payments or the "need to shift costs." The exclusion of static, cross-sectional studies is justified by noting that while comparison is made across hospitals, it is very difficult to control for market or hospital-specific differences. Any result regarding cost shifting may thus be biased. In contrast, this problem disappears in a dynamic setting as the hospitals are used as their own control [Morrisey (1996)[91]].

1982, they found that markups to private patients did not vary systematically with financial pressure. Instead, hospitals cut back on personnel and reduced charity care. Following the same strategy, Zuckerman (1987)[144] examined hospital survey data from 1980 to 1982, and found that, while limited amounts of cost shifting occurred, hospitals were not able to recover all the lost revenue. Moreover, Medicare rate controls led hospitals to contain costs, substitute outpatient for inpatient services and accept lower margins. Thus the burden of government rate cuts fell mainly on the hospitals, not on privately insured patients.

In a study using more recent data, Dranove and White (1998)[28] provided evidence against cost shifting. Examining California hospitals, they compared changes in the net prices and volumes of services for Medicaid, Medicare and privately insured patients between 1983 and 1992. The authors found that reductions in Medicare and Medicaid payments did not lead to increasing private prices. If anything, they were actually lowered. Instead of cost shifting, service levels fell for Medicaid and Medicare patients.

Addressing the inconsistency between profit maximization and cost shifting, Dranove (1987)[24] studied the pricing behavior of non-profit hospitals. He argued that cost shifting may take place for a hospital whose objective function includes both output and profit. Moreover, single- and cross-sector shocks to the profit must be differentiated. If an external shock occurs to only one patient group (e.g., payment cuts for government insured patients), cost shifting leads to negatively correlated profit changes between the groups. If a common shock occurs (e.g., production costs go up for both groups), profit changes are positively related. Cost shifting is thus most readily detected where single-sector shocks dominate in magnitude. Using data from the American Hospital Association's annual surveys in 1981 and 1983, Dranove found that substantial reductions in Medicaid payments in Illinois induced hospitals to shift costs to privately insured patients.

### 2.3.2 Payment Reforms in China

The city of Zhenjiang switched its payment method from FFS to global budgeting in 1997. Immediately following the change, the growth rate of total program spending dropped sharply

from 40% to 20%. Moreover, compared with a similar city without payment reforms, the expenditure growth in Zhenjiang was much smaller. Based on this observation, a research group from Zhenjiang Health Insurance Bureau concluded that global budgeting was fundamental in controlling health care costs [Zhenjiang Health Insurance Bureau (2000)[140]]. However, their study failed to control for demand changes and inter-city heterogeneities that might have confounded the policy effect.

Rehnberg *et al.* (2004)[103] examined the impact of insurance reforms in Nantong, a medium-sized city in Jiangsu Province, in 1997 on hospital charges. Using patient-level data on per episode charges two years before and after the policy change, the researchers found that the reform reduced spending growth for insured patients and that the cost savings came mainly from decreased drug use. They did not find evidence of cost shifting to uninsured patients. A key limitation of their study is that they were not able to differentiate between the effects of demand and supply-side measures that were adopted simultaneously.

Eggleston and Yip (2001)[33] examined the payment reform in Haikou (Hainan Province), where a global budget plus a cost-sharing plan was applied to a subset of hospitals. The study used the difference-in-differences model with the providers still paid on the FFS basis as the control group and analyzed the impact of the payment policies on various utilization measures. Their results showed substantial cost savings associated with the global budget policy. However, without data on uninsured patients, the study could not prove that the reduction in spending on insured services was not accompanied by cost shifting.

### 2.3.3 Contributions of the Paper

This study contributes to the literature on cost shifting in two ways. The first concerns the modeling of the objective function of a Chinese public hospital. We argue that profit maximization is an accurate description of provider behavior in China. As was discussed in Section 2.2.1, economic incentives have become a prominent factor for decision-making in the health care sector. The large share of drug spending, the focus on curative over

preventive care and the internal revenue responsibility system all attest to their importance.[11] With this objective function, the paper removes the analytical inconsistency between profit maximization and cost shifting by introducing a resource constraint. As the relative marginal returns from two sectors (insured *vs.* uninsured patients) vary, the resource constraint will force hospitals to transfer resources from the less profitable to the more profitable sector, creating the substitution effect necessary for cost shifting.

The second contribution of the study is that it defines cost shifting as changes in the *total* provider charge to the uninsured for a given medical contact (e.g., charges per outpatient visit or hospital admission) following an exogenous change in the payment rules. This definition is different from what is used in studies on the US health system, where pricing is a market behavior and hospitals shift costs by increasing the fee charged to one patient group for the *same* services. Because of fee regulations, however, providers in China cannot simply increase their fees. In order to increase the charges, they must persuade the patient to consume services of a larger price tag. In other words, they must change the *content* of the care provided.

Whether this change implies provision of more advanced services depends on the official fee structure. If there is a high correlation between official fees and the actual cost, hospital charges reflect true production cost. Studies on the fee schedule in China confirm that this is indeed the case. Although many services are underpriced, their fees generally increase with the level of technical sophistication [Liu *et al.* (2000)[77]].

The correlation between the official fee and the production cost is an important feature of the model in this paper. In particular, it assumes that the average cost of treatment rises with the technical level of the care provided. Under these circumstances, cost shifting involves real resource cost for the hospital. Raising charges to one patient group is not so much simple pricing behavior as a decision of resource allocation.

[11] The pursuit of financial goals was a frequently raised theme during my discussions with medical practitioners in China. While the impact of changes in the institutional environment is widely acknowledged, the fundamental cause of the pursuit for profit is not clear. Some ascribe it to the shift of the collective mentality from public welfare to individual interests created by economic liberalization. Others characterize it as a survival response to intensified competition among hospitals.

## 2.4 THE MODEL

This paper studies cost shifting in a model of a profit-maximizing hospital serving two patient groups: the uninsured and those covered by the global budget policy. The hospital has a fixed amount of resources available for the production of care for the two groups and all related activities, as defined in the following.

All services are charged at prices on the official fee schedule and applied to both patient groups. Nonetheless, the hospital can influence the *content* of care given to a patient. There are few medical conditions for which standard textbook treatment exists. When there are multiple alternatives, the provider has considerable discretion over what type of care the patient will receive. In the case of China, choices can be made among services with different administered prices. Thus the hospital has control over the charges per episode, through changing the content of medical care. In recognition of this, the model specifies the charge to uninsured patients as a control variable in the hospital's profit maximization problem. Given the definition of price as service charges, quantity is more accurately interpreted as the number of episodes (i.e., out-patient visits or admissions).

Of course, the provider can use the same strategy for an insured patient, providing uncovered services for which the patient pays out of pocket. It thus faces a problem of allocating resources between services on the formulary and those that are not, which is very similar to the allocation problem involving the two patient groups. Therefore, the model can also be applied to the analysis of cost shifting among different services. In this paper, we abstract away from this possibility so as to focus our attention on cost-shifting among patient groups. In the specification of the model, we assume that, within the global budget system, the hospital takes the unit price for each insured case as exogenous. It has control over the quantity, rather than the price, of services delivered to insured patients.

The hospital's goal is to select the profit-maximizing quantity and service charges specific to the two patient groups. Formally, it aims to

$$\max_{q_1,p_2}\{\alpha\min(B,p_1q_1)+[1-\alpha]p_1q_1+p_2q_2(p_2)-c_1q_1-c_2(p_2)q_2(p_2)-CM(q_1-q_0)\}$$

$$\text{s.t.} \qquad c_1q_1+c_2(p_2)q_2(p_2)+CM(q_1-q_0)\leq G,$$

where

$q_1$ = volume of care to insured patients,

$q_0$ = volume of care to insured patients that would arrive without marketing,

$p_1$ = administered price of services covered by the insurance program,

$p_2$ = charges to uninsured patients,

$q_2$ = volume of care given to uninsured patients, assumed to be a function of $p_2$,

$B$ = fixed budget target set by the insurer,

$\alpha$ = cost-absorption rate of the hospital for actual expenditure in excess of $B$,

$c_1$ = average production cost of care to insured patients, assumed constant,

$c_2$ = average production cost of care to uninsured patients, assumed a function of $p_2$,

$CM(q_1-q_0)$ = (de)marketing cost of delivering $q_1$ to insured patients,

$G$ = available resources.

The insurance program sets an expenditure target $B$ for all services delivered to all the members treated at the hospital. The amount is determined by the reported last-period expenses, adjusted by two factors: (1) anticipated exogenous changes in the service volume; (2) differences between the hospital's service volume or unit expenses (i.e., expenditure per visit or per hospital day) and the market averages.[12]

If actual expenditure exceeds $B$, the hospital bears a proportion of the extra expenses. Its cost-absorption rate is $\alpha$. If, on the other hand, actual expenditure is less than $B$, the hospital will be reimbursed for the realized expenses. In the above notation, when $B<p_1q_1$, total revenue from serving insured patients becomes

$$\alpha B+[1-\alpha]p_1q_1,$$

[12]The purpose of the second adjustment is to remove the incentive to secure larger future reimbursement by exaggerating current expenses.

while when $B > p_1 q_1$, total revenue is

$$\alpha p_1 q_1 + [1 - \alpha] p_1 q_1 = p_1 q_1.$$

Variations in $\alpha$ lead to different forms of payment. When $\alpha = 0$, hospitals are paid fee for service. $\alpha = 1$ implies pure fixed budget, while partial cost absorption corresponds to $0 < \alpha < 1$. A direct test of cost shifting is thus the effect of a change in $\alpha$ on $p_2$, the charges to uninsured patients.

For covered services, the hospital takes $p_1$ as exogenously given. As prices also influence the profitability of providing insured care, the effect of a change in $p_1$ on $p_2$ constitutes another test of cost shifting.

For uninsured patients, the hospital's discretion over the type of care determines their expenditure on treatment. Thus $p_2$ should be interpreted as the cost of medical care for the patient. It is determined by the type (i.e., low or high technical level) of care provided. Since the market for hospital services is characterized by imperfect competition, the quantity demanded is a monotonically decreasing function of price. Formally, $q_2 = q_2(p_2)$ and $q_2' = \frac{\partial q_2}{\partial p_2} < 0$.[13] We make further assumptions about the hospital's marginal revenue from uninsured services. Note the first assumption below implies that demand of uninsured patients is inelastic.

$$q_2 + q_2' p_2 > 0;$$

$$2q_2' + q_2'' p_2 < 0.$$

For simplicity, the unit cost of insured care $c_1$ is assumed to be constant. Hence, $c_1$ also measures the marginal cost of services delivered to insured patients. On the other hand, $c_2$

[13]The assumption about a downward sloping demand function implies the hospital does not engage in demand inducement. To increase the volume of service, the demand curve is not shifted outward so that quantity rises under the same price. Instead, price has to be lowered. If demand inducement occurs, to the extent that it is successful, the hospital does not sacrifice quantity when it tries to sell expensive services to patients. The extent of cost shifting derived below from the model containing a downward sloping demand is thus more limited than under demand inducement.

is modeled as an increasing function of $p_2$ to reflect the fact that the unit cost of production must rise as the content of care becomes increasingly sophisticated.

To simplify the analysis below, we make further assumptions about the impact of selecting more advanced treatment on total production cost

$$c_2' q_2 + c_2 q_2' > 0;$$

$$c_2'' q_2 + c_2 q_2'' + 2c_2' q_2' > 0.$$

The inclusion of marketing cost, $CM(q_1 - q_0)$, is intended to capture the concern that the hospital may dump unprofitable patients. This idea is identical to the marketing cost in Foster (1985)[43], who posited that it is costly to attract or refuse Medicare patients. We assume that the hospital can sell $q_0$ to insured patients at any time because of its reputation or market power. To move the volume away from $q_0$, it must pay a marketing cost dependent on the distance between $q_0$ and $q_1$. The case of increased volume is straightforward. To reduce quantity below $q_0$, on the other hand, the hospital will have to turn insured patients away by referring them to other providers, using long waiting lists or shortening their lengths of stay. The explicit avoidance of patients risks being detected and punished by the insurer. Therefore, dumping insured patients is costly.

Assumptions about the marketing cost include:

$$CM = \begin{cases} \geq 0, & \forall\ q_0,\ q_1 \\ 0, & \text{for } q_1 = q_0 \end{cases} \quad \text{(the marketing cost is non-negative)}$$

$$CM' \begin{cases} = 0, & \text{for} \quad q_1 = q_0 \\ > 0, & \text{for} \quad q_1 > q_0 \\ < 0, & \text{for} \quad q_1 < q_0 \end{cases} \quad \text{(the marginal marketing cost of deviating from } q_0 \text{ is positive)}$$

$CM'' > 0, \quad \forall \; q_0 \, q_1$ (the marginal cost of deviating from $q_0$ increases with the distance between $q_0$ and $q_1$)

Finally, the resource constraint specifies that the quantity and the quality of care a hospital can provide is limited by the size of $G$. As will be shown in the comparative static analysis, cost shifting can occur *only* when the resource constraint is binding. This implies that hospitals with excess capacity do *not* cost shift.

### 2.4.1 Patient Dumping

We derive the results of patient dumping by solving the optimization problem.

I. The case of $B < p_1 q_1$

When $B < p_1 q_1$, the hospital finds it optimal to exceed the volume of insured care the insurance program would reimburse in full. Given the payment policy specified above, the Lagrangian can be written as:

$$L = \alpha B + [1-\alpha] p_1 q_1 + p_2 q_2(p_2) - c_1 q_1 - c_2(p_2) q_2(p_2) \\ CM(q_1 - q_0) + \lambda [G - c_1 q_1 - c_2 q_2 - CM(q_1 - q_0)],$$

where $\lambda \geq 0$.

Taking derivatives yields the following conditions:

$$[1-\alpha] p_1 = [1+\lambda][c_1 + CM'] \tag{2.1}$$

and

$$q_2 + q_2' p_2 = [1+\lambda][c_2' q_2 + c_2 q_2'] \tag{2.2}$$

When $\lambda > 0$, the solution is the set $(q_1^*, p_2^*, \lambda^*)$ that solves equations (2.1), (2.2) and the resource constraint. The other case is $\lambda = 0$, where the resource constraint is not binding and the hospital picks $(q_1^*, p_2^*)$ that solves conditions (1) and (2) under $\lambda = 0$.

To determine whether dumping takes place ($q_1^* < q_0$) in equilibrium, consider $p_1$, the mandated price of covered services. Suppose coverage of the insurance program is restricted to low-priced items, whose price is less than the marginal cost of production, $[1-\alpha]p_1 < p_1 < c_1 \leq (1+\lambda)c_1$. Then $CM'$ must be negative for equation (2.1) to hold.[14] Recall that $CM' < 0$ when $q_1 < q_0$. This implies that the hospital would turn insured patients away if covered services were priced below their marginal cost. Since the objective function was specified for the case where $B < p_1 q_1$, this implies $B < p_1 q_0$. Then when the quota is exceeded, it must be that the insurer's reimbursement is less than what the hospital would earn normally from treating insured patients. Intuitively, the hospital refuses care to insured patients when the service incurs losses. Yet it is prevented from cutting insured care all the way to $B$ by the cost of dumping.

On the other hand, when $p_1 > \frac{[1+\lambda^*]c_1}{1-\alpha}$, $CM'$ can be positive for equation (2.1) to hold. Thus $q_1 > q_0$ in equilibrium. Therefore, when the mandated price of insured services is sufficiently high, the hospital invests in marketing efforts to attract insured patients.

Finally, we examine the conditions under which $B < p_1 q_1^*$ holds. Equation (2.1) implies that, in equilibrium,

$$CM'(q_1^*) = \frac{1-\alpha}{1+\lambda^*} p_1 - c_1 \geq -c_1$$

The inequality follows from $\alpha \in [0,1]$ and $\lambda^* \geq 0$. Next, note that $CM'$ monotonically increases in $q_1$. If we let $h(q_1) = CM'(q_1)$, $h^{-1}$ exists. It follows that

$$q_1^* \geq h^{-1}(-c_1).$$

[14]Note that for equation (1) to hold, $c_1 + CM'$ must be positive. In other words, the magnitude of $CM'$ must not be too big. Even if the hospital dumps insured patients, the volume of insured care cannot be much lower than the normal level in equilibrium.

Then, if $B < h^{-1}(-c_1)p_1$, $B < p_1 q_1^*$ holds. Therefore, when the size of the expenditure target is small relative to the regulated fee and production cost of insured services (in particular, when $h^{-1}(-c_1)p_1$), the hospital finds it optimal to exceed the quota.

II. The case of $B > p_1 q_1$

When the hospital does not meet the program's production quota, the Lagrangian of its optimization problem becomes:

$$L = p_1 q_1 + p_2(q_2)q_2(p_2) - c_1 q_1 - c_2(p_2)q_2(p_2) - CM(q_1 - q_0) + \mu[G - c_1 q_1 - c_2 q_2 - CM(q_1 - q_0)],$$

where $\mu \geq 0$.

The first-order conditions are:

$$p_1 = [1 + \mu][c_1 + CM'] \tag{2.3}$$

and

$$q_2 + q_2' p_2 = [1 + \mu][c_2' q_2 + c_2 q_2'] \tag{2.4}$$

The analysis proceeds in much the same way as in the previous case. Specifically, when $p_1 < c_1$, $q_1 < q_0$ in equilibrium. Thus when the regulated fees of insured services are below cost, the hospital's volume shrinks below the normal load. On the other hand, when $p_1 > [1 + \mu^*]c_1$, the hospital invests in marketing efforts to attract insured patients.

To see whether $B > p_1 q_1^*$ holds, we rearrange equation (2.3) to obtain:

$$CM'(q_1^*) = \frac{p_1}{1 + \mu^*} - c_1 \leq p_1 - c_1$$

The inequality follows from $\mu^* \geq 0$. Then, if $B > h^{-1}(p_1 - c_1)p_1$, $B > p_1 q_1^*$.

We summarize the results of patient dumping in the following proposition.

**Proposition 1:**

- *If the insured services are priced below the marginal cost of production, the hospital dumps insured patients by bringing the patient load below the normal level ($q_0$). If the price of covered services is sufficiently above the marginal cost of production, the hospital markets its services to attract insured patients.*

- *Whether the expenditure budget is binding depends on its size relative to the mandated fee and marginal cost of insured services. In particular:*

  1. *If $B < h^{-1}(-c_1)p_1$, the volume of insured patients exceeds the quota.*
  2. *If $B > h^{-1}(p_1 - c_1)p_1$, the hospital finds it optimal not to reach the quota.*

The case where $B < p_1 q_1^* < p_1 q_0$ is applicable to the tertiary hospitals in an urban area to which patients flock for their reputed quality of service. When the mandate price of care is low, the hospital dumps insured patients to reduce the losses from providing insured care. But their ability to do so is constrained by the cost of dumping.

The case with secondary-level hospitals is very different. Since the start of the BMI program, there have been substantial reductions in the patient load of secondary-level providers. This can be interpreted as a decrease in $q_0$. To increase revenue,[15] the hospital invests in marketing to attract patients, but it stops short of meeting the quota because of the cost of marketing. As a result, $p_1 q_0 < p_1 q_1^* < B$. These hospitals are "starved" of business.

### 2.4.2 Comparative Statics

I. The case of $B < p_1 q_1$

[15] This is true as long as $p_1 > c_1$.

Recall that $\lambda \geq 0$. When $\lambda$ equals 0, the resource constraint is not binding. Any change in the profitability of insured services has no effect on the provision of uninsured care, or vice versa. The reason is that when there exist excess resources, changes in income from either of the patient groups can be absorbed by changes in the amount of resource used. The substitution effect is thus lost.

This result implies that only hospitals running at full capacity engage in cost shifting while those with excess capacity do not. Given the fact that there is excess capacity at Chinese hospitals at lower levels (See Table 2.2.), cost shifting is expected to be most visible at large high-level hospitals.

To obtain the effect of cost shifting, we will focus on the case of $\lambda > 0$. We are interested in how $q_1$ changes with respect to $\alpha$, $p_1$, $c_1$ and $q_0$. To test cost shifting, the effects of these parameters on $p_2$ will also be examined. Derivation of the relevant comparative statics, a familiar but tedious exercise, will be supplied upon request. The results are shown here:

- $\partial q_1/\partial \alpha < 0$

  The effect of cost-sharing rate on $q_1$ is negative. The volume of insured care is lower when the hospital has to absorb a larger share of the excess expenditure.

- $\partial q_1/\partial p_1 > 0$

  The effect of a change in the price of covered services on $q_1$ is positive. The lower the return to treating insured patients, the smaller the volume of insured care.

- $\partial q_1/\partial c_1 < 0$

  The effect of the marginal cost of providing insured care on $q_1$ is negative. The more costly it is to treat insured patients, the less insured care delivered. This result, together with the previous one regarding $\partial q_1/\partial p_1$ determines how the volume of insured services changes with the degree of underpricing. In particular, the more the services are underpriced, the smaller the volume of insured care.

- $\partial q_1/\partial q_0$ depends on the sign of $CM'$

  When $q_1 > q_0$, an increase in $q_0$ causes $q_1$ to rise. Intuitively, as the normal load of insured services increases, it becomes less costly to attract a large number of insured patients. Moreover, it is profitable to increase $q_1$ if $p_1 > c_1$. Therefore, changes in the revenue and the cost of providing insured care subsequent to a change in $q_0$ have the same effect on $q_1$.

  When $q_1 < q_0$, an increase in $q_0$ may give rise to a decrease in $q_1$. This result is somewhat surprising because bringing the volume further below the normal level increases the cost of dumping. Unfortunately, the mathematical expression is too complicated to afford an intuitive explanation.

- $\partial p_2/\partial \alpha > 0$

  As treating insured patients becomes less profitable, the hospital makes up for the lost income by increasing charges to uninsured patients. As charges are positively related with the level of sophistication of services, resources are substituted away from the less profitable to the more profitable services.

- $\partial p_2/\partial p_1 < 0$

  The hospital shifts costs if the price of covered services decreases.

- $\partial p_2/\partial c_1 < 0$ if the total marginal cost with respect to $q_1$ changes fast.

  A change in $c_1$ has a negative effect on $p_2$ if $c_1 + CM' - q_1 CM'' < 0$. Recognizing that $CM'' = d(c_1 + CM')/dq_1$ and rearranging terms, we change the inequality into

$$\epsilon(MC_{q_1}) \;=\; \frac{d(c_1 + CM')/(c_1 + CM')}{dq_1/q_1} \;>\; 1$$

  where $\epsilon(MC_{q_1})$ is the elasticity of the total marginal cost with respect to $q_1$.

Intuitively, the quantity of insured care decreases as the marginal cost of production rises. The more elastic the total marginal cost, the faster the total cost of insured care decreases. Then $q_2$ must rise to balance the resource constraint. For $q_2$ to increase, the charge to uninsured patients, $p_2$, must be lowered.

II. The case of $B > p_1 q_1$

The analysis is almost identical to that in the pervious section, save that $\partial q_1/\partial \alpha$ and $\partial p_2/\partial \alpha$ do not appear in the results.

### 2.4.3 Cost Shifting and Hospital Income

As was shown earlier, $\partial p_2/\partial \alpha > 0$ (when $\alpha$ is relevant) and $\partial p_2/\partial p_1 < 0$. The charges to uninsured patients always increase when services to insured patients become less profitable. However, dumping takes place only when the marginal return to insured care is less than the marginal cost of production. Thus the hospital's decision of cost shifting is independent of its dumping behavior.[16]

As the hospital shifts costs, income from insured patients decreases while that from the uninsured rises. The latter occurs because the marginal revenue of raising uninsured charges is positive under inelastic demand. Revenue increases can also be achieved by raising quantities when demand is elastic. It can be easily shown that, with elastic demand, the hospital recovers lost income on the insured by lowering charges and expanding the load of uninsured patients. Thus cost shifting is a response to heightened financial pressure *only* when the demand of uninsured patients is inelastic.

The analysis so far has centered on changes in $p_2$ in response to $\alpha$ or $p_1$. It would seem to suggest that profits are always negatively correlated across the two sectors. This in fact

[16]Note that $q_1$ and $p_2$ are correlated in equilibrium. The "independence" should be understood in the sense that patient dumping is a static concept, while cost shifting is defined in the dynamic sense of the expression.

is not the case. Profits from insured and uninsured care can respond in the same manner to an external shock. This is shown by the partial derivatives of $p_2$ and $q_1$ with respect to $c_1$. When the elasticity of the total marginal cost of $q_1$ is large, a reduction in $c_1$ causes both $p_2$ and $q_1$ to rise. This leads to an increase in profits in both sectors.

Therefore, profits from insured and uninsured care can be positively or negatively related, dependent on the nature of the external profit shock. Revenue changes (i.e., changes in $\alpha$ or $p_1$) create negative correlations, while cost changes (i.e., changes in $c_1$) may have identical effects on the two sectors. It is thus critical to identify the type of shock received by the hospitals. If cost influences dominate, empirical tests based on the changes in charges to insured and uninsured patients may bias against the detection of cost shifting. To test for cost shifting, changes in the production cost of insured care must be controlled for.

Our result is similar to that in Dranove (1987)[24]. In that paper, the unit cost of care is assumed to be identical across the two sectors. Any change in the unit cost is thus a common profit shock. The author showed that, under certain conditions, a common shock has the same effect on profits from insured and uninsured care. We have obtained the same result with a different model specification. However, Dranove's interpretation remains valid for our case. Although of different technical levels, the services provided to insured and uninsured patients share some common production factors, such as physician and nursing personnel, hospital beds and essential equipment and materials. Changes in the cost of any of these factors are therefore common across the sectors. A decrease in $c_1$ may well be accompanied by a lower marginal cost of uninsured care as it may become less costly to provide resource-intensive services to the uninsured. Since the marginal revenue of uninsured care is unchanged, $p_2$ must rise to re-establish the optimality condition. Although not rigorously shown in the analytical model, this interpretation remains fit to the result.

### 2.4.4 Elasticities

It is informative to express the effects of $\alpha$ on $q_1$ and $p_2$ in elasticity terms. In particular,

$$\epsilon_{q_1}^{\alpha} = -\frac{\alpha}{1-\alpha} \times \frac{1}{y[\theta z - \gamma xyz + \varphi x]}$$

and

$$\begin{aligned}\epsilon_{p_2}^{\alpha} &= \frac{\alpha}{1-\alpha} \times \frac{1}{\theta + x[\varphi/z - \gamma y]} \\ &= -\epsilon_{q_1}^{\alpha} yz\end{aligned}$$

As defined above, $\alpha$ is the rate of cost sharing. $\gamma$ is the elasticity of marginal revenue with respect to increasing technical levels of health services. It measures how fast the marginal revenue declines as charges to the uninsured are raised. $\theta$ is the elasticity of marginal cost with respect to rising technical levels. It indicates how fast the marginal cost increases as charges to the uninsured are raised. $\varphi$ is the elasticity of marginal cost with respect to $q_1$. It measures how fast the marginal cost decreases as the volume of insured care is reduced. $x = MR(p_2)/p_1 = MR(p_2)/MR(q_1)$ is the relative marginal revenues of $p_2$ and $q_1$. $y = c_1/MC(p_2) = MC(q_1)/MC(p_2)$ denotes the relative marginal costs of $q_1$ and $p_2$. Finally, $z$ is the ratio $q_1/p_2$.

Examining the expression for $\epsilon_{p_2}^{\alpha}$, one observes that uninsured charges become more elastic to the rate of cost sharing when:

- $\alpha$ increases.

  If the hospital is paid fee-for-service (i.e., $\alpha = 0$), the elasticity becomes 0. The hospital sees no need to shift costs. On the other hand, the degree of cost shifting tends to infinity as the payment method moves closer to a fixed budget (i.e., $\alpha \to 1$).

- $\theta$ declines.

  The more slowly cost grows as the technical level of uninsured services rises, the larger the degree of cost shifting.

- $|\gamma|$ declines.

  The more slowly the marginal revenue of raising technical level decreases, the larger the degree of cost shifting.

- $\varphi$ declines.

  Recall that $q_1$ decreases in response to a rise in $\alpha$. Whether or not the hospital was dumping patients before the change, the cost of insured care declines.[17] Resources are thus substituted away from $q_1$ to providing uninsured care. The more slowly the marginal cost of $q_1$ declines, the more rapidly $q_1$ decreases to allow sufficient resources to be released for the more profitable business. Since the elasticities of $q_1$ and $p_2$ rise simultaneously in magnitude, the degree of cost shifting becomes larger.

- $x$ declines.

  As the hospital shifts costs, it loses $MR(q_1)$ from insured care and gains $MR(p_2)$ from uninsured services at the margin. The smaller the ratio between incremental gains and incremental losses, the higher the degree of cost shifting to make up for the lost income.

- $y$ declines.

  As the hospital shifts costs, it saves $MC(q_1)$ in the cost of insured care and pays $MC(p_2)$ in providing uninsured services at the margin. The higher the ratio between incremental savings and incremental payment, the looser the resource constraint. This implies larger room for the cost of uninsured care to rise. Thus the degree of cost shifting becomes bigger.

- $z$ increases.

  $z$ can rise under an increase in either $q_1$ or $q_2$.[18] Thus an increase in the total scale of production, from either insured or uninsured business, causes the degree of cost shifting to rise. One plausible explanation is that higher service volumes can be translated into

[17] Note that $c_1 + CM' > 0$ in equilibrium.

[18] Recall that the demand function $q_2 = q_2(p_2)$ is downward sloping.

a larger market share. As the hospital gains more market power, its ability to shift costs without fearing losing patients also increases.

We summarize the results regarding cost shifting in Proposition 2.

**Proposition 2**

1. *Only hospitals running at full capacity engage in cost shifting.*

2. *The decision of cost shifting is independent of that of patient dumping. The latter occurs only when the price of covered services is lower than the marginal cost of production.*

3. *When the demand of uninsured patients is inelastic, the hospital deals with decreased revenue from insured services by shifting costs to uninsured patients. If demand is elastic, on the other hand, the financial pressure is removed by lowering charges so as to increase the load of uninsured patients.*

4. *When revenue shocks dominate, cost shifting lowers the income from insured patients while increasing that from the uninsured. On the other hand, when cost shocks dominate, incomes from the two sectors may be positively correlated.*

5. *The degree of cost shifting increases with parameters $\alpha$ and $z$. It decreases with $\theta$, $|\gamma|$, $\varphi$, $x$ and $y$. The parameters are defined as above.*

## 2.5 CONCLUSIONS

Using a model of profit-maximizing hospitals, this paper obtains the following predictions about hospital responses to a shift in the provider payment method from FFS to global budgeting. Hospitals dump insured patients when most of the covered services are priced under their costs. Whether the budget target is binding for a hospital depends on its size relative

to the mandated fee and marginal cost of insured services. Moreover, only when hospitals operate at full capacity and the uninsured patients have inelastic demand do providers shift costs to the uninsured. The degree of cost shifting varies with the correlation between official fees and actual costs, the share of insured patients in the hospital's total volume, and the competition level of the market of hospital services. If the conditions of full capacity and inelastic demand are not satisfied, hospital respond to global budgeting by lowering charges to increase the volume of uninsured patients. Finally, when revenue shocks dominate, cost shifting lowers the income from the insured while increasing that from the uninsured patients. When cost shocks dominate, incomes from the two groups may be positively correlated.

Our findings have important implications for the design of China's urban health insurance system. If there is evidence of cost shifting, the goal of cost control would be compromised since prepayment had little effect on overall hospital expenditure. Moreover, it would have significantly adverse welfare implications. In the US health care market, hospitals may shift costs to commercially insured patients because of losses from uncompensated care to the uninsured. Ironically, the case of cost shifting would be exactly the opposite in China's public insurance program. The providers, especially large tertiary-level state hospitals, may respond by over-charging uninsured patients, thus exacerbating their access problem. Therefore, cost shifting should be of great concern to policy-makers. Given the results of the model, a simple remedy may be to correct the official fee schedule to reflect the real cost of health care production. This measure will not only improve access to care for a vulnerable group of patients, but also ensure the hospitals' financial health.

If, on the other hand, cost shifting does not occur following the switch to global budgeting, it may indicate that some other aspects of the health care reform (e.g., policies encouraging provider competition) have restricted the hospitals' ability to shift costs. In the short run, this suggests that further payment reforms can continue without impairing access to health care for the uninsured.

The theoretical predictions of our model suggest strategies for empirically testing the existence of cost shifting. In particular, the conditions necessary for cost shifting indicate

that facilities operating at full capacity and/or services for which the demand is inelastic are good candidates as objects of analysis. For instance, because of their reputation and market status, urban tertiary hospitals in China run at near full capacity. Therefore, one could test for cost shifting by examining changes in the average charge to an uninsured patient at such facilities following exogenous changes in the regulated service fee or payment rules. Moreover, the result regarding the profits from the insured and the uninsured sectors suggests that, to obtain accurate estimates of cost shifting, concurrent changes in the production cost of insured care must be controlled for.

Our research can be extended in several ways. First, recall from Section 2.2.1 that the insured group is heterogeneous in terms of socioeconomic status. Within this group, the scope for hospitals to shift costs to low-income patients is obviously limited. An interesting extension will be to formally analyze divide the uninsured into two sub-groups by income and relate income with Second, we studied a static model of profit maximization where the "normal" patient load of a hospital is exogenously determined. An interesting extension is to endogenize this variable by solving a sequential maximization problem in which the future normal load depends on current dumping and cost-shifting behavior. Third, we could introduce strategic interactions in a model of Cournot competition involving a social planner and two duopolistic hospitals. This model will allow us to solve for the optimal pair $(B, p_1)$ given the hospital responses to the global budget policy. The setting of Cournot competition will also provide a formal framework with which to investigate the effects of production scale and degrees of competition.

Table 2.1: Structure of Per Capita Expenditure at Urban General Hospitals (%)

| Year | Outpatient Expenditure | | | Inpatient Expenditure | | |
|---|---|---|---|---|---|---|
| | Drugs | Diagnosis & Treatment | Others | Drugs | Diagnosis & Treatment† | Others |
| 1990 | 67.9 | 19.3 | 12.8 | 55.1 | 25.7 | 19.2 |
| 1995 | 64.2 | 22.8 | 13.0 | 52.8 | 30.4 | 16.8 |
| 1999 | 59.9 | 18.2 | 21.9 | 47.2 | 29.7 | 23.1 |
| 2000 | 58.6 | 19.6 | 21.8 | 46.1 | 31.7 | 22.2 |
| 2001 | 57.7 | 20.1 | 22.2 | 45.5 | 31.2 | 23.3 |
| 2002 | 55.4 | 28.0 | 16.6 | 44.4 | 36.7 | 18.9 |
| 2003 | 54.7 | 28.4 | 16.9 | 44.7 | 36.1 | 19.2 |

†: Diagnosis and treatment costs per hospital admission include surgery fees.
Source: China Health Statistical Yearbook (2004), Ministry of Health, China

Table 2.2: Bed Occupancy Rates at Urban General Hospitals (%)

| Year | Total | Ministry‡ | Province‡ | Municipal‡ | County‡ |
|---|---|---|---|---|---|
| 1990 | 88.2 | 100.0 | 97.2 | 88.4 | 83.0 |
| 1995 | 72.7 | 94.6 | 87.3 | 74.2 | 63.4 |
| 2000 | 67.3 | 95.5 | 84.9 | 67.7 | 56.3 |
| 2003 | 70.9 | 90.6 | 85.3 | 72.2 | 59.6 |

‡: Hospitals affiliated with various levels of government.
Source: China Health Statistic Yearbook (2004), Ministry of Health, China

# 3.0 HOW DO HIGH-COST PATIENTS FARE UNDER THE GLOBAL BUDGET POLICY? — EVIDENCE FROM CHINA

## 3.1 INTRODUCTION

As health care spending has grown rapidly in many parts of the world since the 1970s, country after country has turned to prospective payment methods as the solutions to cost inflation. Unlike the cost-based system, prospective payment reimburses providers with a pre-determined amount for a certain quantity of services. Different definitions of "quantity" produce various types of prospective payment methods: per diem, where the unit quantity is an outpatient visit or inpatient day;[1] disease-related groups (DRG), where the unit is a hospital stay with a specific diagnosis;[2] capitation, where the unit is an individual patient;[3] and global budgeting, where the unit is a geographical region or a health system.

Given the non-contractibility or non-observability of certain aspects of health care quality, each of the above methods must strike a balance between cost-containment and the quality of services [Newhouse (1996)[95]]. Indeed, while studies of per diem, DRG and capitation demonstrate their effectiveness in lowering health care spending, the literature also reveals their potential to induce providers to shun costly patients or to skimp on their services. If these risk-selection incentives prevail, cost containment is achieved at the expense of reduced access to as well as quality of care.

[1] Examples include Medicare payments to nursing homes and rehabilitation centers.

[2] Medicare adopted the DRG system in 1983 as a payment policy for hospital care. The method has since spread to the private insurance sector.

[3] For example, some primary-care physicians employed by health maintenance organizations as "gate-keepers" are paid a fixed amount for each assigned member.

In this paper, we analyze these issues in the context of the global budget (GB) system, a payment method that sees increasing use in China's urban Basic Medical Insurance (BMI) programs. Since the late 1990s, many of these regional programs have switched from the cost-based fee-for-service (FFS) to the global budget policy.

Before its adoption by China, global budgeting has seen many years of popularity in Taiwan and various OECD countries.[4] It attempts to contain the growth of health care spending by imposing caps on the total expenditure of a certain region.[5] Since global budgeting directly restricts the overall spending level, most of the current evidence shows that it is effective in lowering total expenditure [U.S. General Accounting Office (1991)[113]], the growth rate of health spending [Eggleston & Yip (2001)[33]], health care utilization [Leonard *et al.* (2003)[69]] or the use of expensive services [Eggleston & Yip (2004)[34]].

However, much of the literature is either theoretical or descriptive in nature. Rigorous empirical studies are relatively rare. Therefore, this literature has yet to produce empirical evidence of a comparable quality and influence to those on other payment methods. In addition, most of the studies focus on the impact on overall spending, without considering the consequences for health care quality or variations in the effect on different patient groups.

Our study aims to fill these gaps in the literature by providing rigorous evidence of the discriminatory effects global budgeting may create for the group of high-cost patients. Moreover, it examines a particular type of GB method that creates very different provider incentives from the one most frequently used in OECD countries. Comparing the outcomes of these variants will produce insights that are of interest to the policy-makers in both systems. A third contribution of our paper is that it uses data from the city of Zhenjiang,[6] whose BMI administration has been particulary active in reforming the local health care system.[7]

[4]Examples of European GB measures include the 1986 and 1993 Health Care Reform Acts in Germany and the "global envelope" policy introduced in France in 1996. Taiwan started its GB system in July 1998 under the National Health Insurance Act.

[5]For more descriptions of global budget systems, see Wolfe and Moran (1993)[125] and the *Journal of Health Politics, Policy and Law*'s special issue on European health policies [*Journal of Health Politics, Policy and Law*, Vol. 30, February-April, 2005].

[6]Zhenjiang is located in the southwest of Jiangsu Province in southern China, with a population of 660,000 as of the end of 2005.

[7]Zhenjiang was one of the two pilot regions where China started its reform of the urban health insurance

Knowledge of its experience thus has substantial value to the other regions of China.

The Zhenjiang Health Insurance Bureau supplied access to its claims database spanning the period between 1995 and October 2006. The data set contains observations of the enrollees' socio-demographic characteristics, employer identifier, facility identifier and reimbursable provider charges for each hospital visit. We define high-cost patients as those whose annual health expenditure lies above pre-defined percentiles of the cumulative spending distribution. To identify the discriminatory effects of global budgeting, we take advantage of a change in the GB policy in 2005 as a natural experiment in a difference-in-differences (DD) model. To examine patient selection, we use the number of visits a high-cost patient pays to a provider of last resort (LR) as the outcome variable. Skimping is measured by the changes in the intensity of treatment before and after the policy shift.

Our results suggest that Zhenjiang's global budget policy induces non-LR providers to select against costly patients by pushing them to LR hospitals. To relieve the cost-saving pressure, they also skimp on the intensity of services delivered to these patients. However, LR providers do not appear to engage in similar behavior. Therefore, the non-LR providers achieve at least part of the risk selection through making the level of their services inadequate for high-cost patients.

The rest of the chapter is organized as follows. Section 3.2 reviews three strands of literature: patient selection and skimping, global budgeting, and the payment reforms in China. Section 3.3 analyzes the discriminatory incentive the global budget policy creates after introducing the history of provider payment reforms in Zhenjiang. Section 3.4 describes the data used in the study. Sections 3.5 and 3.6 present the estimation strategies and the results of the DD model, respectively. Finally, Section 3.7 suggests areas for future research.

system in 1995. Since then, it has taken a series of initiatives on both demand and supply-side measures. For instance, see Liu *et al.* (2003)[75] and Lin *et al.* (2004)[73].

## 3.2 LITERATURE REVIEW

### 3.2.1 Patient Selection and Skimping on Services

Most studies on selection and skimping are built on the theoretical insights of Newhouse (1996)[95] and Ellis (1998)[38]. In his paper, Newhouse argued that the tradeoff between selection and production efficiency is inherent in any provider payment method. Ellis's paper developed an integrated model that predicted all three discriminatory behaviors: creaming, the over-provision of services to low severity patients; skimping, the under-provision of services to high severity patients; and selection, the explicit avoidance of high-severity patients. It showed that, in equilibrium, prospectively paid providers cream low severity patients and skimp on high severity ones. In addition, if there is dumping, there will also be skimping. Both Newhouse and Ellis proved that competition may exacerbate the discriminatory effects of prospective payment.

Most of the empirical literature on selection[8] concerns health maintenance organizations and other managed care plans [Hill & Brown (1990)[58], Morgan *et al.* (1997)[90], Hamilton (2002)[51] and Polsky & Nicholson (2004)[101]]. Selection at the hospital level is less well studied. An early paper is Newhouse (1989)[94] where the author demonstrated that Medicare's prospective payment system (PPS) increased the likelihood for patients in unprofitable DRGs to end up at "hospitals of last resort." A more recent study by Paddock *et al.* (2007)[97], however, found no evidence of patient selection. Examining the impact of case-based payments[9] on the severity level and resource use at Medicare inpatient rehabilitation facilities, they found no significant change in the patient mix before and after the PPS implementation.

Among the empirical studies on skimping, Ellis and McGuire (1996)[40] showed that

[8]There is another strand of research that aims to develop "risk adjustments" in insurance premiums in order to minimize selection. For a sample of this literature, both theoretical and empirical, see Ash *et al.* (1989)[6], Newhouse *et al.* (1993)[96], Brown *et al.* (1993)[11], Eggleston (2000)[32] & Barros (2003)[7].

[9]The payment method Paddock and colleagues examined is called Case Mix Groups (CMG). Similar to DRGs, CMGs classify hospital stays into groups according to the patients' age, impairment, functional status and comorbidities.

the Medicaid DRG policy for mental health services in New Hampshire resulted in skimping on services for the sickest patients. Using discharge and financial data from California, Meltzer *et al.* (2002)[82] also found that the combined force of competition and DRG payments selectively reduced spending on the most expensive patients. These findings confirmed the theoretical predictions of Ellis (1998)[38]; i.e., supply-side cost-saving measures induce skimping on services to costly patients.

### 3.2.2 Global Budgeting

Most of the literature on global budget is based on the European experience. Poterba (1994)[102] expressed skeptical views on the ability of the global budget system to slow the growth of health spending, while van de Ven (1995)[117] questioned its efficiency as a tool of price regulation. Nonetheless, there are many studies that show the effectiveness of global budgeting in cost control. For instance, Ulrich and Wille (1996)[112] found that the global budget system Germany introduced in 1993 had a strong and long-lasting cost-containment effect. Leonard *et al.* (2003)[69] showed that, relative to the case-based payment system, global budgeting was associated with a lower spending level and shorter lengths of stay.

A study by Fan *et al.* (1998)[41] was the first to distinguish between two types of compensation methods within the global budget system: the "expenditure target" and the "expenditure cap." Under an expenditure target, a fixed spending quota is allocated to each provider. Expenditures below the quota are reimbursed in full. If the quota is exceeded, the unit amount of reimbursement for each service will be lowered. In the most rigid form, the unit price is reduced to 0. For smaller fee reductions, there is a partial degree of risk sharing between the insurer and the provider.

The expenditure cap method attaches points to each type of service. At the end of the settlement period, the regional budget is divided by the total number of points summed over all providers so as to determine the unit price of each service. A hospital's revenue is the product of its service points and the unit price of the region.

The target and the cap policies produce very different provider incentives. While the

revenue under expenditure targets depends only on a provider's own volume of services, the expenditure cap relates income to the decisions of the other providers. In their lab experiments, Fan *et al.* (1998)[41] found that, for the same level of spending, the cap policy leads to a larger quantity of services than the expenditure target.

Mougeot and Naegelen (2005)[92] examined the impact of the expenditure cap policy on the quality of care. Using a model of Cournot competition, they showed that, when the number of providers is large, the optimal cap policy may implement the second-best outcome, but cannot implement the first-best outcome. For the same level of expenses, the cap policy always involves a lower level of quality. It increases hospital utility, while decreasing patient utility. The level of social welfare is therefore lower than under the first-best outcome.

In a separate study, Hsueh *et al.* (2004)[61] examined the effects of a switch from FFS to expenditure caps in Taiwan's dental care system.[10] They found that the switch reduced dental care utilization. In addition, global budgeting did not improve the geographical distribution of dental supply in Taiwan.

Since the definition of the "expenditure target" best fits the characteristics of the payment method used in Zhenjiang, we will borrow this concept from Fan *et al.* and use it interchangeably with the term "global budget" in the rest of the paper.

### 3.2.3 Provider Payment Reforms in China

There are a small number of studies on the payment reforms in China. Using data from Hainan Province, Eggleston and Yip (2001[33], 2004[34]) found that a shift from FFS to a monthly global budget reduced the average expenditure per admission. It also slowed the growth of spending on expensive diagnostic services. Meng *et al.* (2004)[86] reported on a comparison between two cities, one with a set of health system reforms, including changes in the provider payment method, and the other without. They found a smaller cost increase in the reform city, without any measurable impact on quality. However, it was impossible to

[10] Their paper used the term "global budgeting" and did not distinguish between expenditure caps and targets.

separate the effects of the payment reform from those of the other policy changes that took place simultaneously.

## 3.3 ZHENJIANG'S PROVIDER PAYMENT REFORMS

### 3.3.1 Reform Chronology

As an experiment of national health insurance reforms, the Zhenjiang BMI program was formed in 1995 by merging two existing insurance systems that covered employees of government institutions and state-owned enterprises. Since the inception, its coverage has gradually expanded to the population of all city residents with stable employment.[11] As a result, the number of beneficiaries almost doubled from 260 thousand in 1996 to 492 thousand in October 2006, the latest month for which data is available. As the program expands, there has been a distinctive trend of aging. The share of individuals under 35 years old declined from 34.9% in 1997 to 24.4% in 2006, while that of those above 65 increased from just under 8% to 14.6%. Aging is therefore an important policy concern for local health authorities.

Financed by employee and employer premium contributions, the program provides mandatory coverage under a single, citywide system. It combines individual medical savings accounts (MSA) with a social pooling fund (SPF). MSAs serve as the first tier of payment. When funds in the patient's MSA are depleted, reimbursements from the SPF become available. The benefits package is identical across economic sectors or employers, to the exception of two groups of enrollees: civil servants and individuals who have received official valediction as "model workers." Coverage for the latter two groups is more generous than for the general population.

Since 1995, the program has undergone a series of major changes. For the purposes of this paper, we discuss only those in the provider payment method.

[11] As is typical with most employee BMI programs in China, migrants without official residential permit are not covered.

1. 1995 - 1996

This was the pre-global budgeting period. As part of the reform initiative, the insurance administration switched its provider payment method from FFS to per diem reimbursement. Under this system, the insurer paid each provider a fixed amount per outpatient visit or inpatient day. The total annual payment to the provider was thus the product of the number of visits/days and the unit amount. Although an improvement over FFS, the per diem method still leaves considerable room for providers to increase the supply of services. Soon after the policy took effect, hospitals in Zhenjiang learned to "beat the system" by inflating the number of visits/admissions. As a counter-measure, the administration changed the payment method to a rigid expenditure target in 1997.

2. 1997 - 1998

As discussed above, the expenditure target is a type of GB measure that divides the city-wide budget into fixed expenditure targets for each contracted provider. The regional budget is determined at the beginning of the period and is set to be equal to the expected premium contributions of the same year. For any provider, the target applies to all the services it delivers to BMI enrollees within a year.[12] This implies that the global budget policy covers the entire spectrum of medical conditions treated at any facility.

The 1997/98 method adopted the most rigid form of expenditure target by providing no risk-sharing for any spending overruns by the provider. In the two years of its existence, this measure put a sharp brake in the growth of health care expenditure in the region [Lin *et al.* (2004)[73]].

3. 1999 - 2000

In 1999, as a result of mounting complaints from the local providers of heavy cost-saving pressure, the insurance bureau narrowed the scope of the expenditure target to the expenses

[12]By contrast, the GB systems of Taiwan, Canada, Germany and France are specific to different sectors of the health care delivery system. The "global" application of the GB method is partially attributable to the comprehensive nature of providers in urban China, where general hospitals offer a wide range of services, including those usually associated with specialty hospitals, such as dental, ophthalmological and Ob/Gyn services.

reimbursed by the SPF account. The restriction on payments made from the MSAs was hence removed.

4. 2001 - 2004

In 2001, the insurance bureau introduced two policy changes: abolishing the payment separation of the 1999/2000 system and incorporating cost-sharing measures into the expenditure target policy. While the 1997/98 system allowed for no spending overruns, the new method reimburses expenditures that exceed the spending target on a capitation basis. In particular, if the number of patients treated by a provider is greater than the average patient load of the previous three years at facilities of the same specialty and administrative level, a fixed payment is made to the provider for each additional patient treated. The payment differs by inpatient and outpatient services. For each service category, it is equal to the average three-year per capita expenditure at comparable facilities.

5. 2005

In recognition of the health needs of an aging population, the insurance bureau amended the payment policy in July 2005 with a clause that exempted patients with chronic diseases from the expenditure target of each hospital. Expenses on the treatment of a defined group of chronic conditions are fully reimbursed.

### 3.3.2 Economics of Patient Selection and Skimping

As discussed above, the expenditure cap policy results in higher levels of services than the expenditure target. However, both methods create incentives to discriminate against high-cost patients. To see this, note that, under an expenditure cap, the unit price depends only on the quantity, rather than the intensity of resource use, of each service. Therefore, it is a best response for a provider to lower the unit cost of care by either avoiding high-cost patients or lowering the intensity of their treatment. The degree of discrimination is restricted by the possibility of decreasing quantity if the high-cost patients turn to the other providers.

In the case of expenditure targets, the provider faces a non-linear price structure: $p$ below the spending quota; and $(1-\alpha)p$ above the quota, where $p$ indicates the price and $\alpha \in [0, 1]$ is the degree of provider cost-absorption. Therefore, whether the provider discriminates against costly patients depends on the size of the target. If the target is large enough to cover the normal patient load, the provider has little incentive to discriminate. In fact, a generous target is not much different from the FFS payment method. It will encourage the provider to increase the intensity of services for all patients. If, on the other hand, the target is strictly binding, the reduced price will induce the provider to lower the unit cost of services. A natural response will thus be to shun high-cost patients or to skimp on their treatment. The degree of discrimination decreases with the level of risk sharing. It is strongest when the provider bears the entire risk of budgetary overruns.

In Zhenjiang's BMI program, whose global budget policy takes the form of expenditure targets, the degree of discrimination evolves along with the payment reforms. In particular, we hypothesize that the 1999 policy change relaxed the discriminatory incentive of the 1997/98 expenditure target for patients with high MSA expenditures. Furthermore, by removing the payment separation while introducing cost sharing measures, the 2001 reform had offsetting impacts on provider behavior. The reimbursement for additional patient loads mitigated the discriminatory effect created by the expansion of global budgeting to MSA accounts. Finally, the 2005 amendment weakened the incentive to select against or skimp on patients with chronic diseases.

## 3.4 DATA

We use claims data obtained from the Zhenjiang Health Insurance Bureau. The data set spans the period between 1995 and October 2006. It covers all reimbursable transactions, including outpatient visits, inpatient stays and pharmaceutical purchases, at every contracted health care facility. There are four types of facilities in the data: general/specialty hospitals,

community health centers, clinics, and pharmacies. For each transaction, the data set records the patient's age, gender, employment, annual wage income, professional distinctions, type of policy held, time of enrolment and reimbursable provider charges by service category. Using the provider ID number in the claims data, we are also able to extract information about a hospital's location, administrative level and type of contract with the insurer.[13]

In the following analysis, we will use only data on outpatient services. Since the occurrences of hospitalizations are rare, the observations on inpatient care may not form a panel data structure necessary for the difference-in-differences analysis. Second, we exclude cases treated at community health centers since their reimbursement falls under the purview of a parallel insurance program that uses capitation rather than global budgeting payment. Drug purchases at pharmacies are also excluded, as the degree of risk selection is minimum at these facilities. Finally, we screen out new enrollees that joined the BMI program in the year of analysis, in order to remove the impact of acquiring insurance on the demand for health services.

The main limitations of the Zhenjiang data are its lack of patient health/severity level and diagnosis information. To the extent that unobserved health or severity level remains fixed over time, the DD model is designed to remove its effect. The latter is a more serious problem. For any outpatient visit or hospitalization, we do not know the condition that was being treated. However, we argue that this limitation does not invalidate our analysis. Unlike the DRG system, the global budget policy imposes cost-control incentives across the entire spectrum of diseases, instead of at the level of specific conditions. Therefore, the providers should respond to high-cost patients in much the same manner, regardless of the particular condition. That being said, nonetheless, there remains a methodological concern with respect to the potential impact of the disease on a patient's elasticity of demand for health care. We will discuss this issue in greater detail in the concluding section.

Apart from the claims data, we obtained statistics of occupancy rates and the share of

[13]Keeping this basic structure intact, the bureau upgraded its database twice, in 1999 and in 2004, increasing the amount of information reported. For instance, the latest database contains more detailed information on the structure of individual copayments than the earlier versions.

the BMI reimbursement in the hospitals' total revenue from Zhenjiang's Health Bureau.

## 3.5 ESTIMATION STRATEGIES

The payment policy reforms described in Section 3.3.1 provide the potential objects of analysis for the DD model. However, it is difficult to study the pre-2001 reforms, since before 2001, Zhenjiang's insurance system was characterized by rapid successions of policy changes. Each new payment method was introduced concurrently with demand-side measures or pricing policy changes. The year of 2001 marked the stabilization of the system. Since then, the only major policy shifts are the changes to the global budget policy: the 2001 refinement of the expenditure target and the 2005 amendment exempting chronic conditions.

A problem with the 2001 refinement is that it affected all hospitals and patients so that we cannot identify cases to be used as controls in the DD analysis. Take patients as an example. As the policy change expanded global budgeting from SPF to MSA accounts, hospitals may have the incentive to attract less expensive outpatient cases, since doing so would increase its reimbursement level by raising the head count. This positive selection could occur independently of the dumping of high cost patients. Using the less expensive patients as controls would confound the two types of selection behavior. Second, if we use hospitals as the unit of analysis, our strategy of measuring selection with the number of visits to last-resort providers would leave no hospital in the control group.

Compared with the 2001 policy, the 2005 amendment provides a cleaner source of identifying variation. Since it is a physiological fact that old people are more likely to suffer from chronic diseases than the general population, it is conceivable that the policy change affected the elderly population more substantially. Therefore, age can be used to define the treatment and the control groups. The effects of the 2005 amendment are thus obtained by comparing the before-after changes in the outcome variables across different age groups.

### 3.5.1 Definitions of Key Concepts

**3.5.1.1 Selection** To examine selection, we look at the number of visits a high-cost patient pays to a "provider of last resort." In interviews with Zhenjiang health authorities, it became evident that low-level facilities often pushed costly patients "upward" to higher-level providers, on the excuse that the latter were better equipped or skilled to treat their illnesses. Therefore, we define tertiary hospitals, which are the highest-level providers in urban China, as "providers of last resort." In Zhenjiang, only 2 out 267 health care facilities are tertiary hospitals.

**3.5.1.2 Skimping** We follow the literature in defining skimping as the under-provision of services to high severity patients. We hypothesize that, apart from pushing costly patients away, a hospital may also respond to cost-saving pressure by reducing how much a high-cost patient spends on each visit. Therefore, the outcome variable in this analysis is the intensity of service use, measured by the average expenditure on an outpatient visit to any non-last resort hospitals.

**3.5.1.3 Costliness of Patients** We use a patient's percentile in the cumulative distribution of annual outpatient expenditure as a proxy for his costliness. It then follows that high-cost patients are those that lie above certain levels of the spending distribution. In our analysis, we use the $90th$ percentile as a threshold.

Due to data limitations, we cannot measure costliness within specific disease groups. Although, as argued above, this is not a major issue in the context of global budget systems, the lack of patient health information presents other methodological problems.

Since health affects health care spending, a patient's costliness, which is defined on the spending distribution, is also correlated with health. Any change in the patient's health level will affect both the degree of costliness and health care utilization. This will create a spurious policy effect.[14] Another concern is that, expansions of the program and the trend of aging

[14] Although this is a lesser problem if the costliness indicator is used only to determine whether an obser-

among enrollees may shift the cumulative distribution function of outpatient expenditure. As a result, a patient's cost percentile may change even without changes in his health level.

To address both problems, we use only the cost percentile of the pre-policy period. This time-invariant, baseline measure is not affected by future changes in either the payment policy or the patient health/severity level. Therefore, the costliness variable represents the degree of cost-saving pressure specific to each patient before the 2005 amendment took effect.

### 3.5.2 Model Specification

Our objective is to estimate the average effects of the 2005 policy on (i) the number of visits by high-cost patients to last-resort (LR) providers; and (ii) the per visit expenditure at non-LR hospitals by the same patients. In a DD model, the parameter of interest is:

$$\triangle = E(y_{1t} - y_{1t'}|X, D = 1) - E(y_{0t} - y_{0t'}|X, D = 0), \tag{3.1}$$

where $E(\cdot)$ is the expectation operator; $y_{1t}$ is the outcome for patients in the treatment group at time $t$, while $y_{0t}$ is the outcome for the control group in the same period; $t'$ and $t$ refer to the pre- and post-policy period, respectively. $D$ is a binary indicator that equals 1 for the treatment group and 0 otherwise.

In our estimation, we define the values of $D$ as follows. It indicates the treatment group if a patient is above the age of 65 and his annual outpatient spending is greater than the $90th$ percentile of the cumulative spending distribution. It indicates the control group if a patient is younger than 65, but also lies above the $90th$ percentile of the cost distribution. In other words, we obtain our comparison groups from the population of high-cost patients. The identification relies on the varying impact of the 2005 policy upon different age groups *within the same population*.

One concern with this identification strategy is that individuals aged between 55 and 65 may be a contaminated control group. This could happen because this group of patients may

vation is included in the estimation. Technically, it reduces sample size of the DD estimation.

also suffer from high incidence of chronic diseases. In addition, if the cost-saving pressures from the above-65 and the 55-65 groups are indeed similar, the provider may invest greater effort in "pushing" or skimping on the younger patients. The reason is that, compared with the very old, the younger group may have lesser health needs and therefore be more receptive to provider advice. As a robustness check, we estimate the model omitting the 55-65 group. Our results are robust to this sensitivity analysis.

We estimate Equation (3.1) on observations within 12 months before and after the July 2005 amendment came into effect; i.e., $t' = 2004$ and $t = 2005$. We choose this relatively narrow window of analysis because, according to the local officials, providers in Zhenjiang respond to changes in the payment policy fairly quickly. Hence, we do not need to consider lags in the policy effect. Another justification is that a patient's unobserved health level is unlikely to change considerably within this short period of time.

The most widely used DD estimator is the parametric version of (3.1):

$$y_{it} = F(X'_{it}\beta_0 + \delta_0 65Costly_{it} + \alpha_0 Policy_{it} + \gamma_0 65Costly_{it} \times Policy_{it} + \mu_{it}),$$

where $i = 1, ..., N$ refers to the individual; $F(\cdot)$ is an arbitrary function; $65Costly_{it}$ is the same as $D$ defined above; $Policy_{it}$ is a binary indicator that equals unity in 2005 and 0 otherwise; and $\mu_{it}$ is a time-varying error term distributed independently of $65Costly_{it}$ and $Policy_{it}$. The parameter $\delta_0$ measures time-fixed difference between the treatment and the control groups; $\alpha_0$ measures the time effect common to both groups; $\gamma_0$ is the policy effect.

$X$ is a vector of covariates that include gender, income, employment status, a binary indicator whether the patient has received any government valediction as an excellent worker, and a binary indicator whether the patient is a civil servant. Income is a categorical variable corresponding to the five income quintiles defined over all the BMI beneficiaries. In terms of employment status, since only employees were eligible for the BMI program, our data do not have information on unemployed individuals. The employment variable takes the value 1 for employed enrollees and 0 for retirees and military veterans. Finally, we include the last

two variables in recognition that official valediction or government employment may entail health benefits in addition to the standard BMI package. These variables are thus used as proxies for the level of insurance coverage.

Examination of the data shows that all of the covariates in $X$ have constant values over time. This suggests that the economy of Zhenjiang may still have much of the planned-era legacy, where the degree of social mobility is low. In the estimation, we take the before-after difference of the outcome and regress it on the set of control and policy variables. In the case of patient selection, the model becomes:

$$\triangle Visits_i = F(\alpha_1 + X_i'\beta_1 + \gamma_1 65Costly_i + \varepsilon_i), \tag{3.2}$$

where $\triangle Visits_i$ is the before-after change in visits to LR hospitals for patient $i$.

The intercept, $\alpha_1$, identifies the common time trend in the number of visits to LR-providers. The coefficient $\gamma_1$ measures the effect of the policy change. Recall that the 2005 amendment softens the providers' incentive to avoid patients with chronic conditions. Hence, we expect $\gamma_1$ to be negative. Because the covariates in $X$ are time-invariant, the fixed difference between the treatment and control groups is not identified. Finally, since there are only two time periods, the problem that DD models underestimate the standard errors if the outcome variable is serially correlated[15] is not a concern for our estimation.

We model skimping in a similar framework. Since per-visit expenditure is a continuous variable, we estimate a linear model:

$$\triangle \ln(Intensity_i) = \alpha_2 + X_i'\beta_2 + \gamma_2 65Costly_i + \upsilon_i, \tag{3.3}$$

where $\triangle \ln(Intensity_i)$ is the before-after change in logged average spending per visit to non-LR hospitals. The parameters $\alpha_2$ and $\gamma_2$ measure the time trend and the policy effect

[15] See Bertrand *et al.* (2004)[8].

on service intensity, respectively. If the hospitals did engage in skimping, the softening of this incentive following the amendment implies that $\gamma_2$ is positive.

Finally, we validate the DD identification strategy by estimating Equations (3.2) and (3.3) on a placebo law generated between 2002 and 2004. To do so, we first draw a random number from the uniform distribution between 1 and 12. These numbers correspond to the months of the year 2003.[16] Then we use the selected number as the point of time when the placebo policy took effect. The DD model is estimated on data within twelve months before and after the fictitious policy. If we found a significant policy effect in this exercise, it would imply that heterogeneous trends between the treatment and the control groups had existed before the 2005 amendment. Any of the impact we obtained earlier would thus be spurious.

### 3.5.3 Estimation

Equation (3.2) is a count data model. The literature suggests several methods for its estimation. First, under assumptions on the functional form of $F(\cdot)$, the model can be estimated parametrically. The two most commonly used models are Poisson and negative binomial (NB). Compared with Poisson, the NB model allows for greater dispersion in the data.

An alternative is nonparametric estimation with matching methods. For each $(y_1|X, D = 1)$, matching constructs its counterfactual, $(y_1|X, D = 0)$, from observations in the control group. Then the policy effect can be estimated as the change in $E[(y_1|X, D = 1) - (y_1|X, D = 0)]$ before and after the policy was adopted. This is the generalized DD matching estimator developed by Heckment *et al.* (1998)[56]. In this paper, we use propensity score (PS) matching estimator with kernel weighting.

In the first step, we estimate a probit model to obtain the propensity scores, the conditional probabilities that a high-cost patient falls in the treatment group given the values of $X$. Then we construct a common support of the predicted propensity scores for the treatment and the control groups.[17] Cases that fall into the common support constitute the set

[16] We limit the placebo policy change within 2003 to ensure that enough numbers of months exist both before and after the policy for the validation analysis.

[17] In particular, we excluded cases in the control group whose propensity score is smaller than that at the

of matched observations.

On the common support, we compute the counterfactual $(y_1|X, D = 0)$ as follows. Let $S_T = (1, 2, ..., N_T)$ and $S_C = (1, 2, ..., N_C)$ be the set of treatment and control observations over the common support, respectively. Then for any $i \in S_T$, we have:

$$\widehat{y_{i1}|D = 0} = \sum_{j=1}^{N_C} \omega(i, j) \times (y_{i0}|D = 0),$$

where

$$\omega(i, j) = \frac{K[\hat{P}(x_i) - \hat{P}(x_j)]}{\sum_{j=1}^{N_C} K[\hat{P}(x_i) - \hat{P}(x_j)]}, \qquad j = 1, ..., N_C$$

and $\hat{P}(x)$ is the estimated propensity score; $K(\cdot)$ is the kernel function given by the standard normal density function.

For each $i$, the matching estimator is defined by:

$$\triangle Visits_i = [(Visits_{i1t}|D = 1) - (\widehat{Visits_{i1t}|D = 0})] - [(Visits_{i1t'}|D = 1) - (\widehat{Visits_{i1t'}|D = 0})].$$

We estimate the average policy effect as the sample average of $\triangle Visits_i$ over all patients in the treatment group. The standard errors are estimated by bootstrap.

The matching estimator has several advantages over the parametric estimates. First, it abstracts away from any arbitrary assumption about the data generating process. Second, it eliminates the bias in a simple DD estimation of Equation (3.2) which arises if some cases in the treatment and the control groups are incomparable to each other. PS matching removes this bias by comparing cases that lie in the common support of their propensity score. Third, matching also addresses the bias from different distributions of $X$ between treatment

first percentile of the distribution of the treatment propensity scores. On the other end, we trim cases in the treatment group whose propensity score is greater than that at the 99th percentile of the distribution of the control propensity scores.

and control groups by weighting the control observations. Given these advantages, we will estimate Equation (3.2) using all the three methods (i.e., Poisson, NB and PS matching with kernel weighting) and compare their results.

In the analysis of skimping, notice that, since all the covariates in $X$ are categorical variables, Equation (3.3) is a fully saturated model. Thus we do not impose strong distributional assumptions by estimating it with OLS. To reduce the biases arising from potential incomparability between the treatment and the control groups, we conduct the estimation within the common support of the propensity scores.

## 3.6 RESULTS

Table 3.1 shows the unadjusted difference-in-differences estimate of the policy effect on patient selection. Compared with younger patients, old patients with chronic conditions reduced their visits to LR hospitals by 3.42 on average following the 2005 amendment. Table 3.2 presents the sample means and standard deviations of the covariates by treatment status. It is clear that elderly and non-elderly high-cost patients differ quiet significantly in their socio-demographic characteristics. In particular, the treatment group has more women, a larger proportion of the wealthiest members of society, more recipients of official valediction and more civil servants. This indicates that the treated group has a higher socio-economic status on average than the control. It is likely that many of its members are retired government or party officials (the so-called "cadres") who enjoy generous insurance benefits. Their large expenditure is thus driven mostly by a high demand for health care services. Overall, the between group differences in all the covariates, except for employment status, are statistically significant at the 1% level.

We present the results of parametric estimation of Equation (3.2) in Table 3.3. Although there are differences in the magnitudes of the coefficient estimates, the Poisson and the negative binomial models reveal similar pictures. In particular, there is a striking trend of

decreasing utilization of tertiary-level hospitals. The time trend parameter is both large and statistically significant. This may reflect the effects of the cost-containment measures Zhenjiang's BMI program had adopted by the year 2005. Another explanation is that the local hospital market became more competitive over the years, with lower-level facilities competing for patients increasingly aggressively.

The most important result is that the coefficient associated with the treatment indicator is statistically significant. This indicates that elderly high-cost patients paid fewer visits to last-resort providers relative to the younger patients following the 2005 amendment. We infer that the policy change did soften the selection incentive created by the expenditure target method. While they used to have to visit a tertiary hospital for basic treatment, patients with chronic diseases were able to seek care from a nearby, lower-cost provider after July 2005. This is a welfare-improving outcome. The patients could not only pay less, but, since there is a considerably larger number of low-level facilities than tertiary hospitals, also have easier access to constant sources of medical care.

In the other results, the policy change led women to reduce their visits to last resort providers relative to men. Use of tertiary-level hospitals also declined for the employed relative to the retired and army veterans. By contrast, the effects of income, valediction and government employment do not change over time. A likelihood ratio test rejects the null of Poisson distribution.

In Table 3.4, the magnitudes of the policy effect on adverse selection estimated from various empirical models are shown side by side. The results of the Poisson and the negative binomial models are not obtained directly from the coefficient estimates. Instead, they are computed as relative changes in the predicted number of visits with and without the policy change. All the standard errors are obtained with bootstrap. The mean differences computed directly from the data is -3.42. The magnitude of the estimated policy effect falls considerably to 2.98 in the Poisson model and further to 2.56 in negative binomial. Finally, the generalized DD-matching estimate[18] is 2.83 and significant at the 5% level. The policy

[18]Results of the probit propensity score regression are available from the author upon request.

change reduced the average number of visits to last-resort hospitals by 2.83 above and beyond the time trend and the time-fixed between-group difference. The average number of visits for the treatment group prior to the amendment was 22.76. Therefore, the policy change produced a 12.43% fall in the number of visits to LR providers.

The results of the analysis of skimping behavior are presented in Table 3.5. We estimated the model at both last-resort and non-last resort providers. The rationale is that, while it is relatively difficult for tertiary hospitals to find excuses to turn patients away, they can relieve the cost-saving pressure of global budgeting by reducing the intensity of services provided to costly patients. As the spending cap was removed, hospitals would have the incentive to increase the level of care to compete for patients with chronic conditions.

Interestingly, this does not seem to be the case. The coefficient associated with the treatment variable is significant for the non-last resort estimation. This result implies that, following the 2005 amendment, non-LR providers increased the average service intensity for elderly high-cost patients by 10%.[19] The coefficient for last resort providers, on the other hand, is small and statistically insignificant. To put it differently, the exemption from global budgeting restrictions led low-level facilities to provide more intensive care for elderly high-cost patients. The behavior of tertiary hospitals, however, did not change significantly from the pre-policy level. This suggests that last resort providers may have engaged in a minimum level of service skimping prior to July 2005.

The differential policy effect on skimping has substantial implications for the selection behavior discussed earlier. One can imagine that, as low-level facilities reduced the intensity of their services without corresponding cutbacks in tertiary hospitals, patients, especially those with greater health needs, would visit the latter more frequently. Therefore, at least part of the selection was achieved by making medical services inadequate for patients with great health needs. The literature has documented this indirect selection among health maintenance organizations in the US. It appears that the same strategy was being used by

[19]The average per-visit expenditure of the treatment group prior to the policy change was RMB912. A 10% increase would imply an additional spending of RMB91, equivalent to USD11 per the exchange rate between RMB and US dollars as of December 31, 2004.

hospitals in China.

Finally, Table 3.6 presents the results of the validation exercise for the DD model. They indicate that the effects of the placebo policy on either patient selection or skimping are not statistically different from 0. The lack of "effect" before the 2005 amendment validates the difference-in-differences identification strategy.

## 3.7 DISCUSSION

This paper studies the incentive global budgeting policies create for providers to select against costly patients and to skimp on their services. It finds strong evidence of adverse selection. To relieve the cost-saving pressure, non last-resort hospitals also skimp on the intensity of services to high-cost patients. However, last-resort providers do not appear to engage in similar behavior. Therefore, at least part of the risk selection is achieved by making the services inadequate to high-severity patients.

Our results confirm the insight of Newhouse (1996)[95] that all provider payment methods must address the trade-off between the goals of cost control and maintaining an adequate level of accessibility and quality of care. Our study showed that global budgeting made it difficult for high-cost patients with chronic diseases to seek care from low-level facilities and, among those who remained at these hospitals, their intensity of treatment decreased. The problem was aggravated by the directionality of the patient transfer from lower-level to tertiary hospitals. This not only reduced the patients' access to a stable source of regular care, but also increased their medical spending. In other words, they had to pay more for an inappropriate style of treatment. Therefore, the type of global budgeting that is indiscriminate with respect to the disease/condition is particularly unfavorable for patients with special medical needs.

Recognition of these negative welfare consequences was clearly the motivation for the

2005 amendment. While it indicates a more nuanced approach to supplier cost-sharing measures, this policy response begets a series of interesting questions. In the most general terms, how does global budgeting affect high-cost patients suffering from other diseases. Furthermore, if adverse selection and skimping is thought to be harmful in most cases, how can the insurer design a global budget system that is more amenable to the particularities of different medical conditions. Second, although the 2005 policy change may have improved the quality and accessibility of care for the chronically ill, it may have compromised the objective of cost control. Both low and high-level hospitals may have the incentive to increase their spending on chronical conditions. It is therefore important to examine changes in the total expenditure by high-cost chronic patients. Third, the Zhenjiang BMI program has experimented with various types of global budget payment, each with a distinctive degree of supplier cost-saving pressure. It will be of substantial policy value to investigate the provider responses to these different policies so as to determine the optimal policy measure for containing the selection and skimping behavior.

There are several caveats to our analysis. First, the lack of diagnostic information may undermine our results. If patients with different medical conditions have distinct elasticity of demand for health care, they may respond to hospitals' selection or skimping behavior in different ways. In particular, the above- and below-65 groups might have different trends in health care utilization without the policy change because older and younger patients suffered from different diseases. It is therefore important that data sets with richer diagnosis information be obtained so as to estimate the policy effects for specific disease categories. Second, we study a policy change that relaxed the cost-saving incentives for providers. The validity of this approach is based on the assumption that providers responds to positive and negative incentives in the same way. However, this may not hold. The literature on incentives has shown that individuals do no consider positive and negative incentives as flip sides of each other. Third, since the claims data only have information on reimbursable services, we are not able to detect cost shifting to uncovered services. If cost shifting exists, the observed reduction in the reimbursed expenditure does not necessarily imply a lower quality of care

for high-cost patients. This may lead to an overestimate of the true magnitude of skimping.

These discussions suggest several areas for future research. First, by running the estimation on data with information on all the services provided and by examining total expenditure as well as spending on various service categories, we can make an accurate assessment of the full use of health resources by high-cost patients.[20]

Second, we can extend our study by directly comparing the different variants of global budgeting the Zhenjiang BMI program has implemented. Although data for the pre-2004 period are available, the rapid policy shifts that characterized these years make it difficult to have a clean analysis of any specific reform measures. A promising alternative is to extend the analysis to other insurance programs, such as the system of Shanghai, that use only the rigid spending target, and make inter-city comparisons. Doing so will not only afford a full view of the welfare implications of different compensation schemes, but also produce valuable evidence on how provider behavior changes in response to fine variations in the payment policy.

[20] Another probable explanation for the pattern of differential spending could be that an exogenous change in medical technology or practice style selectively reduced spending on the high-cost patients. However, I concluded from my discussions with local health officials, administrators of the insurance fund and hospital managers that the hospitals reacted most strongly to changes in the payment policy, not to external technological trends.

Table 3.1: Number of Visits to Last-Resort Hospitals by Age Group

| | 2004 | 2005 |
|---|---|---|
| *Patients younger than 65* | 18.89 | 16.78 |
| Difference 2005 – 2004 ($\triangle Visits^{young}_{05-04}$) | -2.11 | |
| *Patients aged 65 or above* | 22.76 | 17.23 |
| Difference 2005 – 2004 ($\triangle Visits^{old}_{05-04}$) | -5.53 | |
| Difference-in-Differences ($\triangle Visits^{old}_{05-04} - \triangle Visits^{young}_{05-04}$) | -3.42 | |

Table 3.2: Descriptive Statistics of Covariates in the DD Estimation

| Variable | 65 or Above | Below 65 | $t$-statistic |
|---|---|---|---|
| Gender | 0.58 (0.49) | 0.49 (0.002) | -4.62 |
| Employed | 0.68 (0.46) | 0.68 (0.47) | -1.74 |
| Income | | | |
| Highest 20% | 0.26 (0.42) | 0.15 (0.36) | 21.66 |
| 2nd Highest 20% | 0.13 (0.34) | 0.21 (0.41) | 18.75 |
| Mid 20% | 0.09 (0.30) | 0.21 (0.41) | 29.89 |
| 2nd Lowest 20% | 0.09 (0.29) | 0.17 (0.38) | 21.32 |
| Recipient of Valediction | 0.62 (0.49) | 0.004 (0.06) | -1.9e+02 |
| Civil Servant | 0.09 (0.29) | 0.08 (0.27) | -2.98 |
| $N$ | 8532 | 38748 | |

Table 3.3: Parametric Estimation of the Patient Selection Model

| | Poisson | Negative Binomial |
|---|---|---|
| *Policy Variables* | | |
| Time Trend | -1.20 (0.09) | -1.01 (0.19) |
| 65Costly | -0.30 (0.11) | -0.47 (0.23) |
| *Covariates* | | |
| Gender | -0.41 (0.02) | -0.06 (0.02) |
| Employed | -0.13 (0.03) | -0.13 (0.02) |
| Income | | |
| Highest 20% | 0.03 (0.03) | 0.05 (0.03) |
| 2nd Highest 20% | 0.04 (0.03) | 0.07 (0.03) |
| Mid 20% | 0.02 (0.03) | 0.04 (0.03) |
| 2nd Lowest 20% | 0.06 (0.03) | 0.07 (0.03) |
| Recipient of Valediction | -0.17 (0.11) | -0.10 (0.13) |
| Civil Servant | 0.04 (0.04) | 0.04 (0.04) |
| Specification Test of Poisson Model | 3.26 | |
| $N$ | 47,280 | |

Note: The standard errors are robust to arbitrary heteroskedasticity.

Table 3.4: The Policy Effect on Selection against Costly Patients

| | Unadjusted Difference | Poisson | Negative Binomial | DD Matching |
|---|---|---|---|---|
| $\triangle Visits$ | -3.42 | -2.98 | -2.56 | -2.83 |
| | — | (1.00) | (1.17) | (1.28) |

Notes:

1. The policy effects in the Poisson and negative binomial models are computed as:

$$(\widehat{Visits}_{b,1} - \widehat{Visits}_{a,1}) - (\widehat{Visits}_{b,0} - \widehat{Visits}_{a,0}),$$

where $a$ indicates the pre-policy period, $b$ the post-policy period, 1 the treatment group and 0 the control group.

2. All standard errors are obtained using bootstrap.

Table 3.5: The Policy Effect on Skimping

| | Non-Last Resort Hospitals | Last Resort Hospitals |
|---|---|---|
| *Policy Variables* | | |
| Time Trend | -0.80 (0.25) | -1.23 (0.20) |
| 65Costly | 0.10 (0.017) | 0.02 (0.35) |
| *Covariates* | | |
| Gender | 0.001 (0.01) | 0.03 (0.01) |
| Employed | -0.22 (0.01) | -0.06 (0.01) |
| Income | | |
| Highest 20% | 0.07 (0.01) | 0.01 (0.02) |
| 2nd Highest 20% | 0.07 (0.01) | 0.005 (0.023) |
| Mid 20% | 0.03 (0.01) | -0.02 (0.02) |
| 2nd Lowest 20% | 0.03 (0.02) | -0.002 (0.02) |
| Recipient of Valediction | -0.04 (0.07) | 0.01(0.10) |
| Civil Servant | -0.03 (0.01) | -0.007 (0.03) |
| *N* | 47,280 | 30,384 |

Table 3.6: Validation of the Difference-in-Differences Strategy

| *Panel A. Selection* | | | |
|---|---|---|---|
| | Poisson | Negative Binomial | DD Matching |
| 65Costly | -0.019 | -0.028 | — |
| | (0.070) | (0.044) | — |
| Policy Effect | -0.45 | -0.63 | -0.43 |
| | (0.73) | (0.88) | (1.03) |
| *Panel B. Skimping* | | | |
| | | Non-Last Resort Hospitals | Last-Resort Hospitals |
| 65Costly | | -0.02 | 0.02 |
| | | (0.03) | (0.04) |

# 4.0 THE ROLE OF PRIVATE PROVIDERS IN LOWERING THE COST OF HEALTH CARE: EVIDENCE FROM URBAN CHINA

## 4.1 INTRODUCTION

[1]Designing appropriate roles for the government and the private sector in health care delivery is a complex task for transitional economies, where inefficiencies of the planned-era health system may compound market failures. As one of the fastest growing transitional economies, China presents an intriguing case. Although market liberalization has undoubtedly benefited most of its economy, the role of private providers in China's health care sector has remained controversial.

This controversy has assumed the center stage in recent policy discussions as China searches for ways to reform its embattled health system.[2] Some contend that state-owned providers abuse their predominant market status in pursuit of financial interests, thanks largely to government policies that obstruct private entry.[3] One solution is to break up state dominance by encouraging competition from private providers. Another line of argument holds that the profit-seeking behavior results from the economic incentive introduced by the liberalizing measures in the past three decades.[4] Increased competition with private

[1]This paper is co-authored with Gordon Liu of Guanghua School of Management at Peking University, China.

[2]Criticisms of the Chinese health system include reduced access to health care, increased risk of out-of-pocket expenditure, widening disparities across regions and socioeconomic classes, stagnation of population health achievements and health care cost escalation. See Wang (2003)[121], Eggleston *et al.* (2008a)[35], Wagstaff *et al.* (2009a)[118].

[3]As shown in Section 4.2, state-owned institutions possess a predominant share of the market, thanks largely to legal barriers to entry and insufficient information on provider performance.

[4]Within the public health sector, there has been a movement toward financial decentralization since the

providers, many of which are profit oriented, will sanction and hence intensify the motive to over-supply and over-charge for medical services. The solution prescribed by this school is to remove the negative impact of economic incentives by nationalizing the health sector, at least at the level of basic care.[5,6]

At the center of the debate are two issues essential to the efficiency of any health system: provider ownership and market competition. A vast literature has developed to identify their impacts in the hospital care market. Because of the peculiarities of health care, the literature, whether theoretical or empirical, has yet to reach unambiguous conclusions. In addition, it focuses heavily on developed countries, especially the US. Evidence from developing and transitional economies is in short supply [Sloan (2000)[108], Eggleston *et al.* (2008a)[35]]. Differences in their socioeconomic priorities and institutional characteristics make it difficult for results obtained from one type of countries to find direct applications in the other.

In this paper, we aim to alleviate this shortage in the literature by investigating two questions in the context of China: (1) How do state and private providers compare with one another in one important aspect: the price of care, as measured by the total hospital charge for a given treatment episode? (2) What is the association between the price of care and the degree of market liberalization?

Apart from their contributions to the literature, the answers we provide will suggest measures to improve the efficiency of health spending in China, at a critical moment when the government prepares to substantially shore up its share of health care financing.[7] Furthermore, they will inform the health care reforms in other developing and transitional economies, with whom the Chinese health system shares many salient features.[8]

---

1980s. See Section 4.2 for details.

[5]Another rationale for the "pro-government" argument is the public good property of health care.

[6]For detailed discussions of the debate, please visit http://www.chinahealthreform.org, a website dedicated to health reform issues by China Society of Economic Reform.

[7]In its health sector reform report published in April 2009, the government of China promised to increase its health spending by USD125 billion over the next three years [Wagstaff *et al.* (2009b)[119]].

[8]The common features include dominance of state ownership of health delivery organizations, non-universal insurance coverage and limited government administrative capacity. As is the case in China, most of these countries have reformed their health delivery systems with liberalization and incentivization measures [Eggleston *et al.* (2008b)[36]].

In our analysis, we make an important distinction between the *fee for health services* and the *price of health care*. The former refers to the charge for a single service. In China, health service fees are subject to government regulation. In contrast, the price of care refers to the total provider charge for a given encounter with the patient. It depends on not only the fees, but also the type and quantity of services delivered. In this paper, we are interested in the price of health care, since it represents the real cost of the consumption of medical services for a household. For this reason, we will use the term "the cost of care" interchangeably with "the price of care" in the following.

The data we use come from a household survey the World Bank conducted in five Chinese metropolitan areas in December 2005. The survey provides information on spending on the most recent hospital visit by any household member, ownership of the provider visited and a set of patient/provider characteristics. We define the public-private price gap as the difference in hospital charge between the state and the private sectors, and estimate it in a non-parametric endogenous switching regression model to correct for the self-selection bias in the patients' choice of hospital. To answer the second question, we use a series of linear regressions to explore the relationship between various measures of private provider market shares and (1) the price of care; (2) the estimated public-private price gap.

The main findings of the paper are as follows. Our estimation shows that outpatient care is significantly more expensive at public hospitals than at private providers. Moreover, the price gap is larger for several underprivileged social groups, including the poor, the uninsured and rural migrants, than for the general population. Second, the patients' choice of provider is insensitive to the public-private price gap. In the market share analysis, we find strong negative correlations between the price of care and the private providers' share in the market for physicians, especially those with advanced medical degrees. The same is true for the estimated public-private price gap. These findings indicate that, as an increasing number of doctors work for non-government hospitals, the more expensive state providers converge toward the cheaper private sector. More importantly, health services at both public and private hospitals become less expensive.

Our results suggest that policies aiming to facilitate the growth of low-cost private institutions in China will considerably increase social welfare. In particular, they will benefit the underprivileged social groups who experience significant public-private price gaps. Examination of China's health care institutions further demonstrates that development of the private health sector must overcome the barriers of state market control and insufficient information on health care quality. The price gap we find may have arisen because the lack of quality information, especially with regard to private providers, has hindered price competition in China's hospital sector. Our results from the market-share analysis suggest that an effective market-based approach to eroding the information barrier is to liberalize the market for medical personnel. By employing well-trained physicians, private providers can send a credible signal about the quality of their services. This will help dispel the uncertainty around the quality of private hospitals and, consequently, foster market competition on price.

The remainder of the chapter is organized as follows. Section 4.2 describes the institutional characteristics of China's urban health care system. Section 4.3 reviews the literature on provider ownership and competition in the health care market. In Sections 4.4 and 4.5, we discuss the econometric model and the estimation techniques used for analyzing the two research questions: the public-private price gap and market liberalization. The data set used in our analysis is described in Section 4.6. Sections 4.7 presents the estimation results. Finally, section 4.8 concludes.

## 4.2 CHINA'S HEALTH CARE SYSTEM

China's urban health delivery system is organized as a three tier structure, consisting from bottom to top of street level primary care facilities, secondary level hospitals and tertiary hospitals. The level of technical capability rises along the ladder. The system is characterized by the dominance of state ownership. Since the early 1990s, however, there has been widespread opening to the entry of private hospitals [Wang & Zhang (2002)[120], Eggleston

*et al.* (2008a)[35]]. Although generally smaller,[9] private institutions have grown more rapidly than their public counterparts.[10]

Concurrent with the growth of private providers, the Chinese government has considerably reduced its financial support for the state health sector.[11] State-owned hospitals earn the better part of their income from user charges and enjoy complete discretion over the use of revenue surplus. It has been argued that this financial autonomy is part of a larger trend of decentralization in the public health sector, under which government hospitals are increasingly treated as a type of state-owned enterprise upon which incentive-oriented reforms are introduced [Li & Song (2002)[70]].

In most localities, public hospitals are reimbursed on a fee-for-service (FFS) basis according to a regulated fee schedule. The FFS method pays providers a pre-determined fee for each medical service delivered. The literature shows that, since it rewards the quantity, rather than quality, of care, this method is associated with high levels of use, especially of profitable services [Eggleston & Yip (2004)[34]].

Such is indeed the case in China, where fee regulation has further distorted provider incentives. To give implicit insurance to the indigent, the government sets the regulated prices of basic, non-invasive services at below their cost. Hospitals are allowed to cross-subsidize their income by charging handsome mark-ups on more advanced care, such as pharmaceutical products and high-tech diagnostic tests [Liu *et al.* (2000)[77]]. This "dual-track" fee schedule has created strong incentives for providers to over-prescribe drugs and diagnostic tests.[12] In recent years, the government of China has tried to reduce the distortion by increasing the fees of labor-intensive services and lowering those of high-tech care. However, studies show

[9] In 2003, for example, non-profit private hospitals employed 4% of the beds and 3% of the physicians working in urban hospitals [Ministry of Health (2004)[89]].

[10] Between 1996 and 2001, the number of outpatient visits paid to state-owned facilities grew by only 2.1% while it increased by 300% at the private sector [Ministry of Health (2003)[88]].

[11] Government subsidies now account for 10∼15% of public hospitals' operating cost, covering basic wages and the cost of equipment maintenance.

[12] For instance, a study of village clinics found that prescriptions are strongly associated with the need to generate revenue, rather than patients' clinical conditions [Zheng *et al.* (2003)[139]]. Consequently, China has one of the world's highest shares of drug costs in total health spending, standing at 54.7% and 44.7% of outpatient and inpatient expenditure in 2003, respectively. By contrast, the average in the OECD countries is about 15% [Ministry of Health (2004)[89]].

that this policy change has produced limited effects on providers' prescribing behavior [Bian *et al.* (2002)[9], Meng *et al.* (2002)[84], Sun *et al.* (2005)[110]].

Another strategy for correcting provider incentives is to move away from FFS to prospective payment methods. Prospective payment restrains the incentive to over-supply by paying providers a pre-specified amount for a well-defined quantity of services. Various types of prospective payment method have emerged in China's urban insurance system, including: global budgeting, capitation, fixed charges per inpatient day and disease-related groups. In some cases, a mixture of various payment methods is used. Most studies of these payment reforms find that they are effective in reducing health care spending [Meng (2002)[83], Eggleston & Yip (2004)[34], Lin (2004)[74], Wu *et al.* (2004)[133]]. However, evidence of their impact on the quality of care is scant. Chapter 2 of my dissertation finds that the switch from FFS to global budgeting induces hospitals to discriminate against costly patients.

As discussed above, private medical care is a young industry in urban China. Unlike public providers, many private health institutions are excluded from the publicly-financed health insurance systems. The bulk of their income comes from direct patient payments made on the FFS basis. In addition, private hospitals are subject to less government regulation in areas such as pricing, procurement and managerial decisions. Within the private sector, the governing policies differ somewhat by the provider's declared organizational objective. Non-profit institutions can charge fees within a wide range of the official fee schedule. By contrast, for-profit facilities enjoy full pricing flexibility. Furthermore, non-profit hospitals are exempt from income taxes,[13] while for-profit ones are not.

We now turn to the demand side of the health care equation. In urban areas, insurance coverage has declined since the 1990s.[14] Before the economic reforms, the urban health insurance system had two main components, the government insurance scheme (GIS) and the labor insurance scheme (LIS).[15] As the economic reforms proceed, an increasing section

[13]State-owned hospitals are also exempt from income taxes.

[14]The share of insured population dropped from over 70% in the early 1990s to below 60% in 2003 [Ministry of Health (2005)[89]].

[15]GIS covered government employees, soldiers, students and teachers, while LIS insured workers at state-owned enterprises.

of the economy becomes independent of the state while the private sector grows rapidly. As a result, many individuals have fallen out of the state-based medical safety net. In an effort to expand insurance coverage in the urban areas,[16] the government consolidated GIS and LIS in the late 1990s into a single insurance program for all eligible employees, called the urban workers' basic medical insurance (BMI) system. The program is currently undergoing another expansion to the entire urban population, bringing coverage to those formerly uninsured, including children, retirees, the unemployed and the self-employed.[17] However, this expanded program does not cover migrants from rural areas, most of whom do not have official residential status in cities and are hence not entitled to the local benefits.

The urban BMI system uses various demand-side cost-sharing measures, such as copayment and drug/service formularies, to control expenditure. Yet it does not restrain patients' choice of provider with tools such as the gate-keeping system. When a patient, whether insured or uninsured, makes a contact with the medical system, (s)he has full discretion over the hospital and the doctor to seek care from. A standard assumption in the health economics literature holds that patients lack the knowledge to make well-informed decisions with regard to provider choices. Governments and insurers in China have taken few measures to fill this information gap. Without credible information, patients frequently turn to the providers that have good reputation and market standing. In Chinese cities, these are usually state-owned tertiary hospitals, resulting in the over-use of these facilities. Although financial incentives are in place, such as lower prices and more generous insurance reimbursement for serviced provided by lower-level facilities, to direct patients away from tertiary hospitals, these measures have produced limited effects.[18]

[16] Another important motivation was to increase the level of risk pooling from individual "work units" under GIS and LIS to the city level.

[17] In July 2007, the State Council passed the decision to launch the urban resident BMI program. During the same year, pilot experiments were started in 79 localities. According to the official schedule, coverage would expand to 50% of the target population by 2008, to 80% by 2009 and finally to universal coverage by 2010.

[18] The reason is that the price differentials are too modest to have any real effect, or, as one of the results of the paper demonstrates, price is not a key determinant on the patients' choice of provider.

## 4.3 LITERATURE REVIEW

### 4.3.1 Provider Ownership

Studies of provider ownership in the health care sector originate mostly from the U.S., where the differences between for-profit and non-profit hospitals have been extensively analyzed. Theories of the behavior of non-profit hospitals fall broadly into four categories. The first, the altruism class, posits that non-profit hospitals pursue altruistic objectives such as the quality of care [Newhouse (1970)[93]] and charity care [Frank & Salkever (1991)[44]]. The second category, represented by the paper of Pauly & Redisch (1973)[99], holds that physicians take advantage of the hospital resources to maximize their joint income. In the third group of studies, the existence of non-profit hospitals depends on the trade-off between tax benefits available to non-profit organizations and the ability to pursue profit maximization [Weisbrod (1988)[123], Lakdawalla & Philipson (1998)[67]]. Incomplete information characterizes the fourth category, where it is argued that non-profit hospitals are a solution the health service industry develops to the information asymmetry between the consumer and the producer. The nondistribution constraint sends a trust signal with regard to the non-contractible aspects of health care quality [Arrow (1963)[5], Hansmann (1980)[52], Glaeser & Shleifer (2001)[47]].

Empirical studies of hospital ownership have produced mixed evidence. Some suggest that ownership and profit status do not make any difference in the performance of hospitals [e.g., Sloan (2000)[108]], while others find that for-profit providers have lower technical quality and higher mortality rates [e.g., Devereaux *et al.* (2002)[20]].

A related body of literature examines the interaction between providers of different ownership forms. For example, studying the three types of hospitals in the U.S., Duggan (2000)[30] concluded that for-profit and non-profit providers both skimmed for profitable patients, leaving the care for indigent and uninsured individuals to government hospitals. In a later paper, Duggan (2002)[31] found that non-profit hospitals tended to mimic the behavior of for-profit hospitals as competition from the latter increased.

The limited evidence available from China is mixed. Some studies show that public and private providers do not differ significantly in their behavior. They are just as likely to induce unnecessary demand or, if properly paid, to deliver preventive care [Meng *et al.* (2000)[85], Li & Song (2002)[70]]. A study by Eggelston *et al.* (2009)[37] finds that the mortality rates at private providers do not differ statistically from those at similar government hospitals.

On the other hand, there is evidence that the state sector charges a higher price for its services than the private sector. In a study directly related to ours, a research team in Wenzhou (of Zhejiang Province) compares the charges by public and private hospitals for a number of inpatient cases. They find that the state sector invariably has higher charges and longer lengths of stay [Wenzhou Health Economics Association (2004)[122]]. However, this study fails to control for hospital case-mix, thus subjecting its results to biases arising from patient heterogeneities. Our analysis will use methods from the treatment effect literature to address the self-selection bias.

### 4.3.2 Market Competition

The literature on competition in the health care market is also based mostly on the U.S. experience. It documents that, prior to the advent of managed care, hospitals competed on quality to attract patients covered by generous indemnity insurance. This led to rapid spread of advanced technologies, a phenomenon referred to as "*medical arms race*" [Salkever (1978)[105], Robinson & Luft (1985)[104], Dranove *et al.* (1993)[27]]. During this period, competition led to higher prices and socially wasteful outcomes [Dranove & Statterthwaite (2000)[28]].

In the mid-1980s, the rise of managed care and the change in the provider payment method[19] transformed the locus of competition from quality to price. Some studies of this period show that hospital competition not only lowered the cost but also improved the outcome of health care services [Kessler & McClellan (2000)[66]].

A question relevant for our analysis is: in China's hospital care market, where the share

[19] In particular, the change from fee-for-service to prospective payment.

of out-of-pocket payment is high and the purchasing of medical services is scattered, does competition reduce or increase the price of care? The answer is not immediately clear. Competition for cost-conscious patients may not suffice to lower the price. The literature has suggested numerous reasons, including imprecision of the information on price and quality [Dranove & Satterthewaite (1992)[27]], search cost [Satterthewaite (1979)[106]], physician-induced demand [Fuchs (1978)[45]] and brand loyalty [Grabowski & Vernon (1992)[48]].

## 4.4 PUBLIC-PRIVATE PRICE GAP

### 4.4.1 Econometric Model

Our empirical model adopts the framework of the treatment effect literature. Let $Y_s$ and $Y_p$ denote logged expenditure on a visit to a state and a private provider, respectively. For each patient $i$, the reduced-form cost functions can be written as:

$$Y_{si} = \beta_{0s} + X_i'\beta_s + \varepsilon_{si} \tag{4.1}$$

and

$$Y_{pi} = \beta_{0p} + X_i'\beta_p + \varepsilon_{pi} \tag{4.2}$$

where $s$ indicates the state and $p$ the private sector. $X$ is a set of observable patient and provider characteristics. $\beta_{0s}$, $\beta_{0p}$, $\beta_s$ and $\beta_p$ are parameters to be estimated. The error terms $\varepsilon_s$ and $\varepsilon_p$ have zero means and are independent of $X$.

We compute the price differential as the mean difference in per-visit expenditure between the state and the private sectors; i.e., the parameter of interest is $\triangle(X) = E(Y_s - Y_p|X)$. Since the survey reports information on the most recent visit, we observe only $Y_s$ or $Y_p$ for

each patient, but not both. Let $Y_i$ denote the observed expenditure and $S_i$ a dummy variable indicating whether the patient selected a state-owned provider. Then we have,

$$Y_i = Y_{is}S_i + Y_{ip}(1 - S_i). \tag{4.3}$$

To define how $S_i$ is determined, let $s_i^*$ be a latent variable measuring the net utility of receiving treatment at a state hospital. Then we can write:

$$\begin{aligned} s_i^* &= \alpha \triangle(X_i) + R_i'\delta + \varepsilon_{0i} \\ S_i &= \mathit{1}(s_i^* > 0), \end{aligned} \tag{4.4}$$

where $R$ is a set of exogenous variables that may overlap with $X$ and $\mathit{1}(\cdot)$ is the indicator function. Following the standard specification, the variance of $\varepsilon_0$ is normalized to 1.

Equation (4.4) is a structural selection function. A patient visits a public provider if the net utility of doing so is positive. Since higher health care cost reduces the patient's utility, we anticipate $\alpha$, the parameter associated with the expected price gap, to be negative.

Equations (4.1)-(4.4) form a switching regression model in which the change from one state to another is endogenous [Jones (2000)[65]]. The endogeneity arises from the possibility that the unobserved (to the econometrician) factors influencing expenditure ($\varepsilon_s$ and $\varepsilon_p$) are correlated with those affecting the selection of provider ($\varepsilon_0$). In our case, these factors include preference for the state sector, observable aspects of service quality, and the complexity and severity of illness. For example, if the average patient selecting a public hospital is sicker than that going to the private sector, failing to address selection on severity of illness would lead to biased estimates of the public-private price gap. In the following, we will use both parametric and semiparametric methods to correct for the bias.

Identification of the model is achieved with exclusion restrictions. To identify the structural selection equation, we need a variable that appears only in $X$, but not in $R$. We use a dummy variable that indicates whether the patient thinks (s)he received unnecessary

care during the visit. Unnecessary care is significantly correlated with expenditure. If used, it substantially increases the cost of care. Conversely, high expenditure is likely to arouse suspicion of the use of excessive services. To justify that the unnecessary variable does not appear in $R$, we note that studies have shown the public and the private hospitals in China have equally strong financial incentives to over-prescribe [Meng *et al.* (2000)[85]]. More importantly, they are indistinguishable in popular perception in terms of the tendency to use unnecessary care [Lim *et al.* (2004)[72]]. Therefore, the anticipation of unnecessary care does not influence the choice of state or private providers.

The expenditure functions are identified with a variable that appears in $R$, but not $X$. We use a binary indicator of the ownership of the patient's employer. It takes the value 1 if the employer is a state-owned entity, and 0 otherwise. The rationale behind this strategy is that the old GIS and LIS schemes, which covered employees of the state economic sector, provided full reimbursement for expenditure at appointed public hospitals. Because of this legacy, employees of the state sector have a stronger tendency than the general population to use public providers, even in the new insurance system.

A potential drawback of this strategy is that employer ownership may directly influence the spending on care for various reasons. For example, workers may self-select into state employment on the basis of their health status. If an average state-sector employee is less (or more) healthy than the private employee, the estimated "price gap" will confound the real price difference with the effect of health needs on expenditure. To avoid this bias, we include the patients' self-evaluated health level as a covariate in the structural selection equation. A similar problem may arise if the state sector offers more generous health benefits than the other employers, so that state-sector employees can afford to spend more on medical care. However, such is not the case in China, where the new BMI system provides equal benefits across all economic sectors. Therefore, employer ownership (controlling for patient health level) is a valid identifying variable for the expenditure functions.

### 4.4.2 Semiparametric Estimation

In the parametric approach to the estimation of Equations (4.1)-(4.4), the error terms $(\varepsilon_0, \varepsilon_s, \varepsilon_p)$ are assumed to be trivariate normally distributed [Heckman (1979)[54], Vella & Verbeek (1999)[116], Wooldridge (2001)[126]]. Using the diagnostic methods described in Pagan and Vella (1989)[98], we reject the joint normality assumption for our data. Moreover, we find evidence of substantial heteroskedasticity in both expenditure equations. Therefore, we adopt a more general framework that allows the conditional expectations of $\varepsilon_s$ and $\varepsilon_p$ given hospital ownership to enter the expenditure equations nonparametrically.

**4.4.2.1 Reduced-Form Selection Equation** In the first step, we substitute Equations (4.1) and (4.2) into (4.4) to derive a reduced-form selection function, written as:

$$S_i = 1(Z_i'\gamma + \varepsilon_i), \tag{4.5}$$

where $Z = (X, R)$.

Since our diagnostic tests did not reject the normality assumption for the choice function, Equation (4.5) is estimated as a probit model, from which we obtain $\widehat{P}$, the estimated probability of the patient selecting a public hospital.

**4.4.2.2 Correction for Self-Selection Bias** We correct for selection bias by estimating the following equations:

$$Y_{si} = \beta_{0s} + X_i'\beta_s + U_s(Z_i, S_i) + \nu_{si} \tag{4.6}$$

and

$$Y_{pi} = \beta_{0p} + X_i'\beta_p + U_p(Z_i, S_i) + \nu_{pi}, \tag{4.7}$$

where $U_s(Z_i, S_i) = E(\varepsilon_{si} \mid Z_i, S_i = 1)$ and $U_p(Z_i, S_i) = E(\varepsilon_{pi} \mid Z_i, S_i = 0)$.[20] The error terms $\nu_s$ and $\nu_p$ satisfy the usual assumptions.

Equations (4.6) and (4.7) are partial linear models, where the functional form of the non-parametric parts, $U_s$ and $U_p$, is unknown. Under the standard index sufficiency condition,[21] it is easy to show that $U_s$ and $U_p$ depend on $Z$ only through $P$, the probability of receiving the treatment [Amemiya (1985)[3], Heckman (1980)[55], Heckman *et al.* (1998)[56]]:

$$U_k(Z, S) = U_k(Z'\gamma) = U_k(P(Z))$$

With this simplification, we estimate Equations (4.6) and (4.7) with the differencing-based method developed by Yatchew (1997[136], 2003[137]). In his work, Yatchew shows that this method is valid only if the number of arguments in the nonparametric functions is no greater than 3.

To implement the differencing-based method, we sort the data, within each sub-sample, by ascending values of $\widehat{P}$. Subsequently, an $m$-order differencing is taken of the sorted data. For example, the first-order differencing produces:

$$Y_{ki} - Y_{k,\,i-1} = [X_i' - X_{i-1}']\beta_k + [U_k(\widehat{P}_i) - U_k(\widehat{P}_{i-1})] + [\nu_{ki} - \nu_{k,\,i-1}] \tag{4.8}$$

Yatchew shows that, if $U_k$ is continuous and has bounded derivatives, $U_k(\widehat{P}_i) - U_k(\widehat{P}_{i-1})$ vanishes in large samples. Then an OLS regression can be run on the differenced data to obtain consistent and $\sqrt{n}$-normal estimates of $\beta_k$. That is,

$$\hat{\beta}_k = (\widetilde{X}_k'\widetilde{X}_k)^{-1}(\widetilde{X}_k'\widetilde{Y}_k), \tag{4.9}$$

where $\widetilde{X}_k$ and $\widetilde{Y}_k$ are the differenced data.

Notice that taking differences as in Equation (4.8) removes the intercept terms in the expenditure equations. However, intercepts are essential in the computation of the average

[20] These terms would be the inverse Mill's ratios in the parametric model.

[21] The condition requires that $R$ and $Z$ be exogenous and that the dependence between $S$ and $(\varepsilon_s, \varepsilon_p)$ arise only through $\varepsilon_0$.

price gap. Therefore, we use the method developed by Andrews and Schafgans (1998)[4] to recover these terms. The Andrews-Schafgans estimator is

$$\hat{\beta}_{0k} = \frac{\sum_{i=1}^{N_k}(Y_i - X_i'\hat{\beta}_k)\, S_i\, h(Z_i'\gamma - \lambda_k)}{\sum_{i=1}^{N_k} S_i\, h(Z_i'\gamma - \lambda_k)},$$

where $k = s$ or $p$. $\hat{\beta}_k$ is the estimated slope coefficient obtained from Equation (4.9). $h(\cdot)$ is a weighting function defined as in Andrews and Schafgans (1998)[4]. The parameter $\lambda_k$ is the bandwidth or the smoothing parameter. By varying its value, we control the proportion of observations used in the estimation of the intercept.

Once we obtain $\hat{\beta}_{0k}$ and $\hat{\beta}_k$ ($k = s$ or $p$), the parametric parts of Equations (4.6) and (4.7) are moved to the left-hand side of the equations to create new dependent variables:

$$\begin{aligned}\ddot{Y}_{ki} &= Y_{ki} - \hat{\beta}_{0k} - X_i'\hat{\beta}_k \\ &= Q_k(\hat{P}_i) + \nu_{ki}.\end{aligned}$$

In this paper, we use the local linear regression estimator to estimate $Q_k(\widehat{P})$ nonparametrically. The smoothness bound is chosen by minimizing the cross-validation function. According to Yatchew (2003)[137], this modular approach yields consistent and asymptotically normal estimates of the nonparametric functions, since the convergence rate of the parametric coefficients, $\hat{\beta}_k$, is much faster than that of $\widehat{Q}_k(\widehat{P})$.

**4.4.2.3 Estimation of the Public-Private Price Gap** With the above results, we compute the estimated public-private price differential, $\widehat{\triangle}(X)$, as:

$$\begin{aligned}\widehat{\triangle}(X) &= (\widehat{Y}_s - \widehat{Y}_p)|X \\ &= (\hat{\beta}_{0s} - \hat{\beta}_{0p}) + X'(\hat{\beta}_s - \hat{\beta}_p).\end{aligned}$$

Notice that, since $Y_s$ and $Y_p$ were defined as logged expenditures, $\widehat{\triangle}(X)$ is also on the log scale. For our result to have any relevance for policy discussions, we must convert the logged

price gap to the original scale in order to obtain $E(W_s|X)/E(W_p|X)$, where $W_k = \texttt{exp}(Y_k)$.

Various studies have shown that $E(W_k|X)$ depends not only on $E(Y_k|X)$, but also on the conditional distribution of the error term in the log transformed model [Manning (1998)[80], Manning & Mullahy (2000)[81], Ai & Norton (2008)[2]]. In this paper, we use the semiparametric derivative estimator developed by Ai and Norton (2008)[2].[22]

Finally, let $\widehat{D}(X) = \widehat{E}(W_s|X)/\widehat{E}(W_p|X)$. Then we can obtain the mean price gap by averaging $\widehat{D}(X)$ over $X$ in some region $J$. That is,

$$\overline{D}(J) = \int_J \widehat{D}(X) dF(X), \tag{4.10}$$

where $F(X)$ is the CDF of $X$ and $\overline{D}(J)$ is the average public-private price gap over $J$.

We produce interesting results by varying the definition of $J$ over which the average gap is estimated. In particular, we define various sub-samples on the metrics of income, employment, insurance and official residential status, and calculate $\overline{D}(J)$ for each sub-sample. This allows us to examine the average price gap relevant for different socioeconomic groups.

**4.4.2.4 Structural Selection Equation** To estimate the structural selection equation, we substitute the estimated logged price gap, $\widehat{\triangle}(X)$, in Equation (4.4) and run a Probit regression. This step produces consistent, but inefficient, estimates of the parameters of the structural selection function. Since we do not adjust for the fact that the regressors contain the estimate, rather than the real, value of a variable,[23] the standard errors of the estimated coefficients are underestimated. However, this turns out not to be a problem since, as will be shown in Section 4.7.4, the unadjusted estimate of $\alpha$, the parameter of real interest, is statistically insignificant. Further adjustment will only reduce its significance level.

[22] There are other methods that account for the conditional distribution of the error term [Duan (1983)[29], Manning (1998)[80], Ai & Norton (2000)[1]]. However, these methods require either homoskedasticity of the errors or knowledge of the parametric form of their distribution function. To our knowledge, Ai and Norton (2008)[2] provide the most general approach by allowing for heterskedasticity of any form.

[23] In particular, $\widehat{\triangle}(X)$.

## 4.5 MARKET SHARE ANALYSIS

### 4.5.1 Econometric Model

In this part of the analysis, we examine the association between the share of private providers in a city's health care market and (1) the realized price of hospital care; (2) the estimated price gap. This is equivalent to asking:"With the individual characteristics controlled for, *to what extent can regional variations in the cost of care and the public-private price gap be attributed to differences in the market share of private providers?*"

We operationalize this by adding regional variables, including the market share indicator, to Equations (4.1) and (4.2) to estimate the impact of the private market share on $Y_i$:

$$Y_{kig} = \beta_{0k} + X'_{ig}\beta_k + \theta_1 M_g + C'_g\theta_2 + \varepsilon_{kig}, \tag{4.11}$$

where $k = s$ or $p$; $i$ indicates individual patients; $g = 1...G$ refers to the city. In our data, $G = 5$. The variable $M_g$ measures the market share of private providers and $C_g$ is a vector of other macro-level variables that affect a city's health care spending. Since we are interested in only the average effect of $M_g$ on the price of care, $\theta_1$ is constrained to be equal for both public and private providers.

We apply the same method to analyzing the association between the private market share and the estimated price gap:

$$\widehat{\triangle}(X_{ig}) = \tau_1 M_g + C'_g\tau_2 + \mu_{ig}, \tag{4.12}$$

where $\widehat{\triangle}(X_{ig})$ is the estimated price gap for patient $i$ in city $g$, and $\mu_{ig}$ are random errors.

If $\theta_1 < 0$, the average cost of health care in a city decreases with the market share of private hospitals. If $\tau_1 < 0$, the pricing levels of state and private providers converge as the private health sector expands.

#### 4.5.1.1 Indicators of Market Liberalization

Our analysis intends to infer the effect of market liberalization from the association between price/price gap and private provider market shares. The validity of our approach depends on two inter-related issues: (1) whether private market share is an appropriate measure of the degree of liberalization; (2) whether it can be considered exogenous.[24]

To address the first question, note that the government of China holds considerable control over the entry of private providers through such means as accreditation, licensing and quota. The share of private hospitals in the market is therefore a direct result of the degree of openness of health sector regulation.

Nevertheless, there still are methodological concerns. The problem of reverse causality may occur if governments of areas where the demand for health care services, and hence their prices, are low face less resistance from the public sector to open up the market. Furthermore, the private market share and the price or price gap may both be correlated with other factors. The following section discusses the variables we use to control for the some of the confounding factors. However, our data do not have information on three important aspects: the production cost of health care services, the level of medical technology and the depth of insurance coverage.

Low production cost, in terms such things as low wages, both reduces the price of care and attracts private providers to set up facilities. Second, medical technology may create the natural barrier to entry. If the prevailing technological level of an area is high, it may be difficult for private hospitals to expand in the market due to insufficient investment or expertise. In such cases, the association between high prices/large price gaps and low private market shares is attributable to technology rather than an "illiberal" market. Finally, since China's urban health insurance programs tend to exclude private providers from their networks, shallow insurance coverage, where a large number of services are uncovered, may be correlated with both low prices and high private market shares. Not having information

[24] Although the market share variable varies by only five areas, this does not invalidate our examination of the effect of market liberalization on individual outcomes. As Wooldridge (2003[127], 2006[128]) explains, the validity of cluster-sample analysis depends not so much on the sample size on the cluster level as on the exogeneity of the aggregate variables.

on these potentially confounding factors remains a limitation of our data.

**4.5.1.2 Controls for Inter-City Heterogeneities** Since the number of cities in our data set is very small, only limited room is available to address inter-city heterogeneities and other specification issues. To overcome this restriction, we run repeated estimations of Equations (4.11) and (4.12), alternating the market share indicator and the other city-level variables used. This can be thought of as a rough robustness test of our specification.

We use five candidate measures of the private provider market share: the percentage of outpatient visits paid to private hospitals, the shares of high-tech medical equipment,[25] hospital beds, physicians and physicians with MD degrees[26] employed by the private sector. The first indicator measures the private share in the service market, while the rest reflect liberalization of the input markets.

Apart from the private market share, we control for inter-city heterogeneities in three other aspects: income level, population health, and the availability and utilization of medical resources. For each aspect, we have a group of candidate variables, each of which contributes to the regional variations in health care expenditure in distinct ways.

In the case of income level, we use three candidates: per capita disposable income, savings rate and the Gini coefficient. Per capita income indicates the level of economic development, while savings rate reflects other factors that may also affect health care spending, such as the price level and the propensity to consume. The Gini coefficient measures the inequality of the income distribution. In a highly unequal society, the public-private price gap may be driven mostly by income inequality, if poor patients favor a particular type of providers, either public or private, for low-cost care.

Second, we select five indicators to control for population health: neonatal mortality rate, maternal mortality rate, life expectancy, emergency-room (ER) death rate and intensive-care-unit (ICU) death rate. Of these variables, life expectancy reflects the health needs

[25] Equipment such as MRI machines and CT scanners.

[26] According to the regulations in China, physicians with at least the bachelor's degree are allowed to practice medicine upon passing a national certifying exam.

of an aging society. Infant and maternal mortality rates reveal the status of a region's health system [Jamison *et al.* (2006)[64]].[27] In particular, reducing neonatal and maternal mortality demands of a health delivery system the type of abilities, such as the effectiveness of risk-screening, service delivery and response to clinical emergencies, that affect the general quality of all medical services. Finally, the other two variables of this category, ER and ICU death rates, indicate the severity of urgent and difficult medical cases, as well as the health profession's ability to manage them.

We control for regional differences in medical resources with the following variables: number of hospital beds per 1,000 persons, number of physicians per 1,000 persons, general occupancy rate and occupancy rate at state hospitals. The numbers of hospital beds and physicians measure the supply of health care resources, while the occupancy rates reflect their utilization. We incorporate the latter indices to address the balance between the demand and the supply forces of medical services. In particular, a low demand for services provided by state hospitals may lead to both a small public-private price gap and a high private market share. We control for this by introducing the occupancy rate at the state sector.

Given their distinct effects on health spending, we alternate the use of the above variables, rather than select any of them arbitrarily. Choosing one from each of the four groups and running the estimation on Equations (4.11) and (4.12) separately leads to a total of 600 procedures. If, for Equation (4.11), a private market share indicator yields negative and statistically significant coefficients in most of the procedures, this provides consistent evidence that market liberalization lowers the price of hospital care. Likewise, we obtain evidence that liberalization reduces the public-private price gap if a market-share indicator has a significantly negative effect in most of the regressions on Equation (4.12).

[27] Infant and maternal mortality rates are also highly correlated with a region's level of economic development, a factor we already control for.

### 4.5.2 Cluster Sample Analysis

Equations (4.11) and (4.12) examine the impact of aggregate-level variables on individual outcomes. To obtain correct inference on $\theta_1$ and $\tau_1$, we adopt the minimum distance-type estimator developed by Wooldridge (2003)[127].

## 4.6 DATA AND VARIABLES

Our data come from a household survey the World Bank administered in December 2005 in five metropolitan areas: the Pudong region of Shanghai, Shenzhen (Guangdong Province), Dalian (Liaoning Province), Xi'an (Shaanxi Province) and Chengdu (Sichuan Province). The survey produced retrospective and current data from a random sample of households selected with a multi-stage sampling method.[28] To our knowledge, except for a World Bank report on health care utilization patterns, our paper is the first study that uses this data set.

The data contain cross-sectional observations on the use of various types of health care services, including hospitalizations and outpatient visits. This paper uses only outpatient data. The reason is that the high cost of inpatient care in China places substantial financial burdens on households, especially for the poor and the uninsured.[29] This may induce a high degree of simultaneity between inpatient spending and household income. Therefore, we examine only outpatient expenditure in order to avoid the simultaneity problem. Since a patient may have multiple outpatient visits during a year while we observe only the most recent episode, we assume that there is no monthly or seasonal fixed effect on expenditure.

As employer characteristics are necessary for the identification of our model, individuals under the legal working age of 18 are excluded from the estimation. We also screen out cases treated at specialty facilities, such as hospitals for otolaryngology and communicable diseases.

[28] For details regarding the sampling methodology and a full of the survey instruments, please contact the authors.

[29] According to World Bank calculations, the average cost of hospitalization in 2003, just under 4000 RMB for an inpatient stay, was equivalent to 43% of per capita income. For a patient in the poorest quintile of the population, the ratio was nearly 200% [World Bank (2005)[132]].

The reason is that specialized care represents an area where a high degree of differentiation exists between the public and the private sectors. Facilities for disease prevention are usually government-owned, as the low profitability of these services is unlikely to attract private providers. Moreover, it has been documented that specialization in services not covered by the urban health insurance program (BMI) is a strategy used by many private providers to circumvent the dominant public sector [Meng *et al.* (2000)[85], Lim *et al.* (2004)[72], Eggleston *et al.* (2009)[37]]. Given this differentiation, we should exclude specialty hospitals in order to increase the level of comparability between the two sectors.

Our screening process produces a sample of 1,955 cases, of which 85.6% were treated at a state hospital. Table 4.1 lists the definitions and descriptive statistics of the variables used in the estimation, separated by provider ownership. The last column shows the t-statistics for tests of equal means between the two samples. The four groups of candidate variables used in the market share analysis, shown in Table 4.2, are collected from regional statistics and health yearbooks.

### 4.6.1 Dependent Variable

The dependent variable is logged total hospital charge for the most recent outpatient visit in the past 12 months. It is the sum of the patient's out-of-pocket payment and insurance reimbursement (if the patient is insured). As shown in Table 4.1, a state provider charges higher on average than a private hospital. The difference is significant at the 1% level.

### 4.6.2 Variable of Provider Ownership

We create the key conditioning variable from the survey question regarding the ownership of the selected provider. The original question specified five types of providers: state-owned, private domestic, private joint-venture, private foreign and others.[30] We recode this variable by merging the last four groups into one category and defining it as the "private sector."

[30]The category of private domestic providers includes collectively owned facilities. The survey does not specify what the term "others" refers to.

### 4.6.3 Identifying Variables

The values of the identifying variables are as expected. Table 4.1 shows that approximately equal proportions of patients treated at a public or a private hospital reported receiving unnecessary services. In addition, the (suspected) use of excessive care has a substantial impact upon expenditure, with those reporting unnecessary services spending over 76% more (significant at the 1% level) than those who did not.

As described in Section 4.4, we use the ownership of the patient's employer to identify the expenditure functions. In our data, this type of employers includes government agencies, educational institutions and state-owned enterprises. It is clear from Table 4.1 that state employees are more likely to select a public hospital than those working in the private sector (significant at the 1% level). On the other hand, expenditure does not vary significantly by the patient's sector of employment.

### 4.6.4 Other Variables

The other regressors we use in the price gap model are standard. In particular, we control for the patient's age, gender, marital status, self-reported health level, family income, official residential status, insurance status, employment status and education. We also include indicators of provider characteristics.

The variable of health status is measured on a 5-level scale. Family income is the sum of monthly incomes of all household members.[31] It is recoded into quintiles, from the poorest to the wealthiest 20%, within each city. The residential status of an individual is determined by the area where (s)he is officially registered as a resident. It is an important socioeconomic indicator in China, especially for the vast army of migrant workers who temporarily relocate from rural areas to seek employment in cities. It determines access to local welfare benefits, such as stable employment, housing and health insurance. In our data, we count a family as migrant if more than two of its members have non-local residential status. The variable

[31] We also estimated the model using family per capita income. The results are very similar.

on health insurance includes three categories: job-based insurance, voluntarily purchased insurance and no insurance. The first category refers to coverage under BMI and GIS programs, both of which are closely tied with an individual's employment. Most cases in the second category are policies purchased from commercial insurance companies, while there is also a small number of patients receiving government assistance for health care expenditure. Although the latter is not obtained through voluntary purchasing, the government may well dispense medical subsidies based on an individual's health needs or income level. Therefore, the degree of selection may be equally high for the two types of insurance. Furthermore, compared with the BMI and GIS programs, their level of benefits is considerably lower. For these reasons, we consider it appropriate to place them in the same category. In terms of employment status, there are four possible states: unemployed, retired, not working and employed. Among these, those "not working" are individuals who are of a legal working age but decide to deter employment to obtain further education or training. In our data, these are mostly college students. Since the vast majority of higher education institutions in China are run by the government, we assign "state-owned" to the employer ownership variable for these individuals. Finally, the patient's education level and the provider characteristics are as defined in Table 4.1.

The behavior of key socioeconomic indicators, including income, residential status, insurance and employment, is of central interest in our analysis. A methodological concern is that their values are rarely randomly determined. Instead, they are influenced by factors that may affect health care expenditure or the choice of providers. In our model, we control for the most important confounding factor — the patient's health level. We assume that, conditional on health, the socioeconomic indicators are uncorrelated with the error terms.

Our data are limited on medical conditions and provider characteristics. They do not report the type of illness for which hospital care was sought. Neither do they provide information on the characteristics of the hospitals beyond their specialization and administrative level. As will be discussed in Section 4.8, this may cast doubt on the comparability between

the state and the private sectors.[32]

As Table 4.1 shows, the patient groups at the state and the private health sectors differ significantly from each other in various aspects. In particular, those selecting a public hospital are older, better educated, and more likely to be local residents or retired. They also have slightly lower self-evaluation of health, but higher income and better insurance coverage. Moreover, utilization at the state sector is concentrated in high-level general hospitals, while the type of private providers most frequently used is low-level outpatient clinics.

## 4.7 EMPIRICAL RESULTS

### 4.7.1 Semiparametric Regression

Results from Probit regression of the reduced-form selection equation (4.5) are shown in the first column of Table 4.3.[33] The identifying variables are well-behaved. In particular, the ownership of the patient's employer is a strong predictor of the choice of provider. The point estimate is 0.373, equivalent to a marginal effect of 0.04, and statistically significant at the 1% level. On the other hand, the use of excessive care does not differ significantly across the hospital sectors. Diagnostic tests of normality and heteroskedasticity find no misspecification of the model.

Before estimating the expenditure equations (4.6) and (4.7), it is necessary to define a common support for $\widehat{P}$ between the state and the private sub-samples. Heckman *et al.* (1998)[56] show that estimating the average treatment effect outside the common support introduces a bias that arises from comparing the incomparable. After data trimming, 79% of the public ($S = 1$) and 89% of the private samples ($S = 0$), or a total of 1,572 observations,

[32] This problem is partially alleviated by excluding specialty hospitals from the sample. In theory, moreover, these unobserved heterogeneities, like the unobserved severity of illness, are corrected for in the switching regression model. Essentially, the concern is that, if data were available on these variables, including them in the estimation would reduce the overlapping region of the probabilities of selecting the state sector. See Heckman *et al.* (1998)[56] for discussions.

[33] As with all tables in this section, the figures in the parentheses give the standard errors of the estimates.

remain in the overlapping region.

We report the estimation results of the expenditure equations in Tables 4.4, 4.5 and 4.6. In each table, various corrections for self-selection bias are considered, including: (i) no correction; (ii) parametric estimation based on the normality assumption; and (iii) differencing-based semiparametric correction.

To our knowledge, there is no empirical evidence regarding the optimal order of differencing,[34] nor the bandwidth parameter in the estimation of intercepts. Therefore, we experiment with various choices of parameter values, and examine the sensitivity of the results to these choices. In particular, we select orders of 1, 5, 10, 25 and 50,[35] as well as bandwidths that allow for 2.5%, 5%, 10% and 20% of the observations to be used in the intercept estimation.

Since we are essentially interested in how the state and the private health sectors compare with one another, Table 4.4 presents the differences in the estimated slope coefficients between Equations (4.6) and (4.7). Comparing the first two columns of the table, we observe that estimates of the slope coefficients are very similar with no correction and with the parametric correction for selection bias. In fact, neither of the correction terms (i.e., the inverse Mill's ratios) in the parametric model is statistically significant.

In the semiparametric estimation, the results are very sensitive to the choice of the differencing order. The values of the coefficient estimates vary substantially. In a few cases, even the signs are different. There does not seem to be a discernable trend in the variation. We believe that the instability of the semiparametric estimation is attributable to the small number of observations from private hospitals. Recall that 251 observations in the private sample survived the trimming process à la Heckman *et al.* (1998)[56]. By taking an order of 50, for instance, we would lose 20% of the observations. This indicates that, although higher orders of differencing increase the efficiency of estimation in large samples, they impose a cost of lost precision for small samples.

We test the semiparametric models against the nulls of: (i) no correction; and (ii) the parametric specification. The results are presented in the bottom panel of Table 4.4. They

[34] In general, as the order of differencing increases, the estimator approaches asymptotic efficiency.
[35] Yatchew (2003)[137] gives the optimal differencing weights for each order.

show that, except for the cases of the private sub-sample with orders of 5 and 10, both nulls are rejected at the conventional level. This indicates that not correcting for self-selection would create considerable bias in estimation. Furthermore, normality is not an appropriate assumption for our data. However, given the sensitivity of the semiparametric results to the parameter choice, we will still consider the parametric estimate as a viable alternative.

Despite their instability, however, the differencing-based estimates do produce consistent signs in front of the key socioeconomic indicators (with the exception of the "migrant" variable). Hence, we are able to draw a general picture of how the treatment for patients of various socioeconomic status differs across the hospital sectors. In particular, note that most of the coefficients in front of the following variables are positive: Migrant, Poorest 1/5 Household, No Insurance and Unemployed. Furthermore, those associated with income and employment status are statistically significant. This finding indicates that, *ceteris paribus*, the charge for a migrant, poor, uninsured or unemployed patient relative to the reference groups is higher at the state than at the private sector.

To demonstrate this pattern more clearly, we present in Table 4.5 the estimated coefficients associated with the socioeconomic indicators for the state and the private sub-samples separately. As seen from the table, a poor patient spends significantly less than an affluent patient at both hospital sectors. However, the expenditure gap is considerably narrower in state hospitals. Furthermore, if visiting a private provider, unemployed patients spend less than individuals with stable employment. Yet this difference disappears in the public sector.[36] As will be shown in Section 4.7.3, these results suggest that the public-private price gap is larger for these disadvantaged groups than for the most well-to-do.

The last row of Table 4.5 shows that the use of unnecessary services has a strong impact on expenditure. Combining this result with Table 4.4, where it was shown that this impact does vary across the hospital sectors, we conclude that the identifying variable for the expenditure equations is valid.

Table 4.6 presents the estimated intercepts obtained with the Andrews-Schafgans esti-

[36] A similar pattern is observed of residential and insurance status. However, the differences in spending between migrants/uninsured patients and the reference groups are not statistically significant.

mator of various bandwidth parameters. It shows that, unlike those in the differencing-based regression, the results of intercept estimation are fairly stable with respect to both the choice of bandwidth and the order of differencing. One peculiar finding concerns the standard errors of the estimates. For the private sector, the standard errors decrease, as expected, with the proportion of the observations used in the estimation, with the exception of the level of 2.5%. This is another indication that methods that would increase the efficiency of estimation in large samples, such as selecting a higher order of differencing or a smaller proportion of observations, may create substantial instability in small samples.

### 4.7.2 Public-Private Price Gap

We report the estimated public-private price gap with various corrections for self-selection bias in Table 4.7. Not surprisingly, the results of the semiparametric model are very sensitive to the choice of parameters. To choose the optimal parameters, we compute the values of the cross-validation (CV) function given each combination of differencing order and bandwidth parameter. Our computations show that following combinations minimize the CV function: (1) order of 1 & 5% of observations; (2) order of 10 & 5% of observations; (3) order of 10 & 10% of observations; and (4) order of 10 & 20% of observations. These parameters give a set of optimal estimates for the price gap: $(92\%, 99\%, 103\%, 139\%)$.[37]

Notice in Table 4.7 that this optimal set of semiparametric price gaps is only slightly above the parametric estimate of 91.6%. However, since their standard errors are considerably smaller, we prefer the results of the semiparametric estimation to those of the parametric model.

An interesting finding in Table 4.7 is that substantial price gaps emerge only after we correct for self-selection bias, either parametrically or semiparametrically. In fact, the price differential estimated without correction is negligible. This suggests that the unobservable factors upon which patients select a hospital tend to increase the expenditure at the private

[37]The figures are obtained by subtracting 1 from $\overline{D}$ defined in Equation (7) and multiplying with 100%. The standard errors are computed with the method described in Ai & Norton (2008)[2].

sector. For example, the cases treated at private hospitals may be more severe on average than those at public providers. It may be that, while they favor the state sector as the first choice, patients visit private hospitals mostly for cases that are too severe or complicated to be treated at the state sector. In this sense, private hospitals may be regarded as "providers of last resort." Another explanation is that patients may be attracted to the private sector by the observable characteristics of its quality, such as a clean and comfortable environment, friendly staff and efficient services, and are willing to pay a premium for these qualities. In both cases, failure to correct for selection would overestimate the "pure" impact of private ownership on the price of care and, consequently, underestimate the public-private price gap.

*Policy Implications*

Taken together, our results provide strong evidence that hospital care is significantly more expensive at the public sector. In this section, we discuss alternative explanations for this substantial price gap.

The first possibility we consider is the structure of China's health care market. Recall from Section 4.2 that state providers own a predominant share of the market in urban areas and that the development of the private sector is a recent phenomenon. The state dominance could contribute to the public-private price gap in various ways. First, private providers may benefit from what Eggleston *et al.* (2009)[37] call the "late entrant" effect. In particular, private hospitals have far fewer retirees to provide for than public hospitals. Therefore, their production cost could be much lower.[38] Second, state providers may charge substantial premiums for their services by taking advantage of their dominant market status.

Nevertheless, whether arising from production cost or pricing behavior, the price gap could not have been sustained were there not factors that obstruct competition between public and private hospitals. One important factor is the policy barrier to entry for private providers. Although the central government recognized the legal status of the private health sector in the early 1990s, there have been few policy measures that encourage its development.

[38]Our data do not have observations on hospitals' wage costs. Therefore, we are not able to test this hypothesis.

On the contrary, studies of local-government policies reveal discrimination against private providers in terms of accreditation, access to financing, participation in insurance networks and professional associations, and personnel and procurement policies. Because of these restrictions, public hospitals have been able to maintain their dominance of the health care market [Guan (2003)[49], Tao *et al.* (2004)[111]].

Our data allow us to test the effect of one of the discriminatory policies: participation in insurance networks. The BMI system, the biggest third-party payer in urban China, excludes many private providers from its provider networks. Restricted to the state health sector, patients with BMI coverage may visit private providers only for conditions or services not covered by BMI. Therefore, the public-private price gap may simply be the result of the difference in insurance coverage.[39] To test this hypothesis, we estimate the price gap for the sub-sample that (i) excludes employment-based insurance; or (ii) contains only uninsured patients. The rationale is that if the price gap is driven by the difference in insurance coverage, the charges for patients without BMI coverage or any insurance at all should be equal across the public and the private hospital sectors. Our estimation[40] shows that substantial price gaps remain for these patients. Hence, we reject the hypothesis of insurance coverage. In the section on market share analysis, we will discuss another hypothesis: personnel policies.

The second explanation we consider is the quality of care. In particular, public hospitals may charge higher prices simply because they offer better-quality services. Although our data do not contain information on health care quality, evidence from the literature does not lend strong support to this explanation. For instance, using data from a random sample of village clinics in Shandong Province, Meng *et al.* (2000)[85] find virtually no difference across public and private providers in observable measures of quality, such as training of health personnel, medical equipment and working conditions. Li and Song (2002)[70] analyze the transformation of state hospitals into share-holding organizations and find no evidence that quality problems are associated with any particular ownership structure. Finally, a

[39]Note that using employment-based insurance as a regressor in this case does not remove the difference since BMI coverage is practically useless at non-participating private hospitals.

[40]These results are available from the authors upon request.

recent study by Eggleston *et al.* (2009) [37] finds that mortality rates at private hospitals in Guangdong Province do not differ statistically from those at state providers of a similar size and case mix.[41]

However, there still is widespread concern among patients about the technical quality of private hospitals. The World Bank survey used in our study reported that, while patients were satisfied with the private sector on various observable aspects of quality, they ranked private providers below state hospitals in terms of technical capability. The household survey studied by Lim *et al.* (2004)[72] also shows considerable distrust in the quality of private providers. We believe that at least part of the discrepancy between findings from the literature and the popular perception is attributable to lack of information on health care quality. There is no reliable source in China, whether a government agency, an insurer or an independent organization, that collects and circulates quality information, especially evidence of outcomes quality at private hospitals. Unable to judge the quality of care, patients naturally turn to the public sector for its long-term market standing. As a result, uncertainty about the quality of private hospitals may have hindered competition between the state and the private sectors, which in turn sustains the substantial public-private price gap.

### 4.7.3 Price Gap for Various Socioeconomic Groups

Table 4.8 presents the estimated price gap specific to various socioeconomic groups. The estimates corresponding to the optimal parameter values demonstrate that, to the exception of employment status, the price gap is considerably larger for the socially disadvantaged than for the privileged groups. The differences are particularly striking between the lowest and the highest income groups. These results are consistent with our earlier discussion of the estimated coefficients associated with the socioeconomic indicators. They indicate that health care at the public sector is not only more expensive, but more expensive to a greater extent for underprivileged patients.

[41] Most of the cited studies use descriptive analysis. More rigorous evidence regarding the outcomes quality of care in China is needed.

Several key characteristics of China's health delivery system point to a plausible explanation for this regressive relative price structure. As discussed in Section 4.2, the fee schedule at the public hospital sector is subject to government regulation. More importantly, the regulation distorts the behavior of state hospitals by creating strong incentives to over-prescribe expensive drugs and services. Such incentives are much mitigated for private hospitals which enjoy greater freedom in pricing their services. In addition, their dominant market status has severely blunted the public providers' responsiveness to patients' circumstances. Studies often find that patients are much more satisfied with private hospitals' readiness in answering their needs than with the public providers [Lim *et al.* (2002)[71], Lim *et al.* (2004)[72]]. Therefore, private hospitals may have a stronger incentive to price discriminate according to the patients' ability to pay. Public providers, on the other hand, may not find it necessary to lower the charges for underprivileged patients since the latter usually have weak bargaining powers against the hospitals.[42]

### 4.7.4 Structural Selection Equation

Columns 2-6 of Table 4.3 report the estimation results of the structural selection equation. The only set of variables that has a significant impact on the choice of provider is hospital characteristics. In particular, patients are more likely to select a state provider if it is a general hospital or a high-level facility.

The most important finding is that the expected price gap, while having a negative sign as anticipated, does not have a significant effect on the choice of provider. This result is somewhat surprising, since, given the large share of out-of-pocket payments in China's health care spending, one would expect the price differential to have a strong effect on the cost-conscious consumers. Our finding suggests the importance of non-price factors, including hospital location and perception of service quality, in China's health care demand function.

[42] Another possible explanation for the variations in price gap by socioeconomic status is that the underprivileged patients frequent low-cost, low-skill private providers and go to a state hospital only for severe conditions. However, to the extent that differences in the severity of illness and observed service quality are observed by patients and taken into account in their selection, our model sufficiently controls for these heterogeneities.

In particular, recall our earlier discussion of the distrust in the quality of private hospitals. The uncertainty about quality may be so strong as to make it difficult for patients to shop on prices. Instead, they look to certain provider characteristics, such as administrative ranking, as proxies for quality. This provides further evidence that imperfections of China's health care market have created and sustained a substantial price gap between the public and the private hospitals sectors.

### 4.7.5 Market Share Analysis

In this section, we present only the results obtained using the differencing order of 10 and 10% of observations in the intercept estimation. The other results corresponding to the optimal set of parameter choices, which are available from the authors upon request, are very similar. Figures 4.1 and 4.2 show the proportions of regressions in Equations (4.11) and (4.12) that return a negative coefficient for the various private market share indicators. Table 4.9 reports the median estimate for each indicator. Combined, these results reveal a striking picture.

The share of physicians working in the private sector, especially those with doctoral medical degrees, is strongly associated with decreases in the price of care. About 80% of the regressions in (4.11) and (4.12) using the share of doctoral physicians at private hospitals produce a negative coefficient. Both median estimates are large and statistically significant. The same is true for the share of physicians, though to a lesser degree.

If we examine the structure of the outcome market, measured by the share of outpatient visits paid to the private sector, we also find that a stronger presence of private hospitals is associated with both lower individual charges and smaller public-private price gap.

However, increasing the amount of hospital beds and medical equipment in private hospitals does not appear to be effective in lowering the price of care. Only a small proportion of the estimations using these as indicators yields negative coefficients. The median estimate for the share of beds is positive and marginally significant, while that for medical equipment is statistically insignificant.

Reductions in the price gap indicate a convergence of pricing levels between the public and the private sectors. In addition, the negative correlation between the individual cost of care and private market shares implies that the average prices at both sectors fall as the private hospitals expand. Therefore, our findings provide preliminary evidence that liberalization of the markets for hospital care and, more importantly, for physicians leads the price at the expensive state sector to converge to that of the cheaper private sector. In addition, the average prices at both sector decrease.

*Policy Implications*

These findings have important implications for China's health system reform. As we demonstrated earlier, patients are not responsive to price differences when selecting a hospital. As a result, simply allowing competition for individual patients may not be effective in fostering price competition. Indeed, studies of other health care systems suggest that competition for insurance contracts and production inputs (e.g., physicians and hospital managers) offers greater opportunities in reducing the cost of care [Docteur & Oxley (2003)[21], World Bank (2005)[132]].

In light of the international literature, our results suggest that an effective mechanism of market liberalization is to increase the private providers' competitiveness in the market for medical personnel. Recall our earlier discussion that patients' concern about the quality of care may have discouraged the competition between the public and the private sectors. Liberalizing the market of physicians will give private hospitals greater access to the most critical input for the production of health care. This will not only increase the quality of their services, but, more importantly, send credible signals about their credentials and technical skills. Patients will select the private sector more willingly, given the knowledge that they will be treated by well-qualified health workers. Once the information barrier to the private sector breaks down, the level of competition in the outcome market will increase. Since the vast majority of patients in China do not have generous insurance coverage, competition is likely to rise on the dimension of price rather than quality. Consequently, the cost of care

will fall.[43]

To liberalize the market for physicians, the government must first remove the policy barriers to access for private providers. Apart from monetary compensation, non-financial incentives, such as professional ranking and access to research grants, are important determinants on physicians' utility in urban China. Yet current regulations prevent most private hospitals from offering these benefits. As a result, physicians are generally reluctant to join the private sector out of concerns of poor career prospects. If hiring doctors from other areas, private hospitals must also overcome the obstacle of obtaining legal residential status for their employees [Tao *et al.* (2004)[111]]. In summary, private providers have substantial difficulty attracting and retaining medical personnel. Based on our findings, we argue the these barriers should be removed to create opportunities for price competition in China's health care market.

Finally, we discuss the impact of liberalization on the quality of care. One might be concerned that if a large number of physicians move from state to private hospitals, the quality of care may fall at the public sector. Figure 3 shows that this may be an unlikely scenario. The figure plots the number of outpatient visits per physician between 1990 and 2006. We can see that, while the number of visits per doctor at high-level hospitals increased during this period, the workload at low-level facilities fell in general, despite a mild increase after 2000. The graph indicates that there may be an excess supply of physicians at low-level hospitals. As the private health sector expands, one would expect doctors at these facilities to make the first move to private hospitals. This re-allocation of human resources may strengthen the private sector's competitiveness without significantly affecting the quality of services at state providers.

[43]If intense competition in the input markets drives up the production cost, liberalization may actually increase the overall price of medical services. However, our results indicate the contrary; namely, larger private shares of physicians are associated with lower prices in both the state and the private sectors.

## 4.8 DISCUSSION

In this paper, we analyze the public-private price gap in China's urban health care market. After correcting for self-selection bias, we find that outpatient services are not only much more expensive in the state sector, but more expensive to a larger degree for the disadvantaged social groups than for the well-off. Paradoxically, this substantial price gap does not have a strong impact on the patients' choice of provider. In the second part of the analysis, we examine the effect of expanding the private health care sector. Our results show that a stronger private sector is associated with both lower individuals charges and smaller public-private price gaps. Moreover, the mechanism of market liberalization matters. In particular, liberalizing the market for medical personnel has the greatest potential for fostering effective price competition between the public and the private sectors.

How we interpret the above results has important policy implications. The first question is whether the public-private price gap should be of concern to policy-makers. Obtained in a model of rational individuals, the price differential appears to be a legitimate outcome of utility-maximizing behavior. For several reasons, however, it is unlikely a socially optimal outcome. More importantly, there is considerable room for government policies to increase social welfare. As is typical for health care, the patients' choice of provider is based on incomplete information. In particular, lack of information on the quality of private hospitals may have discouraged the selection of provider on price. The price gap may thus arise from the public providers' rent-seeking behavior as they exploit their superior market status. In addition, since the gap is larger for disadvantaged social groups, the underprivileged patients may face substantial barriers to access. The government may wish to narrow the gap for these patients out of equity concerns. Policies that facilitate the growth of low-cost private institutions or allow for pricing flexibility within the state sector may considerably increase social welfare.

Our second finding of low price consciousness in the choice of provider may result from the patients' weak bargaining power and inability to judge the quality of services. The

international literature suggests that, under such circumstances, the capacity of the insurer to improve system incentives, through such means as selective contracting and provider payment methods, should be emphasized. Furthermore, local governments or insurance funds can play an important role in the collection, organization and dissemination of quality-related information.

Finally, our results regarding private provider market shares suggest that an effective mechanism for lowering the price of health care is to liberalize China's market for medical personnel. By employing well-trained physicians, nurses or managers, private providers can send a credible signal of the quality of their services. This will help dispel the uncertainty around the quality of private hospitals and, consequently, foster market competition on price.

The main drawback of our study arises from data limitations. Our data set provides no disease information. If differentiation of services is a principal survival strategy for private providers, the patient groups at the two sectors may be very different in their medical conditions and, consequently, health care spending. Furthermore, the data have limited information on provider characteristics. Apart from specialization and administrative level, there are many other characteristics that may affect our results, including size, location, years of practice, technical/education level of medical staff, etc. Lack of such information may undermine the comparability between our samples of state and private hospitals.

More importantly, our study calls for future efforts of data collection and research on the effect of competition on China's health care system. Our data offer no direct information on market competition. We need better measures of the degree of market liberalization. More importantly, we need to find exogenous variations that can identify the effect of liberalization on price. Furthermore, the share of such things as beds, doctors and visits owned by private hospitals does not reveal the real structure of the market. We do not know whether expanded private entry leads to market differentiation or head-to-head competition with the state establishment. Nor are we able to tell how private expansion influences the way in which patients select hospitals. Better data, such as panel data, are needed to examine the causal link between competition and price.

In addition, the price of care has been the sole subject of this study. Future research is necessary to examine the impact of competition, or more precisely, private entry, on patient health outcomes, such as rate of recovery and future medical spending. Another interesting topic is the effect of increased competition on the hospitals' pricing behavior. Stronger empirical evidence is needed to explore whether competition leads to uniform pricing or price discrimination, and the implications of the pricing behavior on provider profits and social welfare.

Table 4.1: Definitions & Descriptives of Variables in the Switching Regression

| Variable | State Provider $N_s$ = 1,673 Mean (S.D.) | Private Provider $N_p$ = 282 Mean (S.D.) | $t$-statistic |
|---|---|---|---|
| DEPENDENT VARIABLE | | | |
| Logged Hospital Charge | 5.53(1.05) | 4.92(1.22) | -7.89 |
| INDIVIDUAL CHARACTERISTICS | | | |
| Age | 45.6(14.4) | 41.6(12.9) | -4.79 |
| Gender | 0.42(0.49) | 0.41(0.49) | -0.50 |
| Married | 0.86(0.33) | 0.89(0.33) | 1.07 |
| Self-Reported Health | | | |
| *Poor* | 0.02(0.15) | 0.02(0.15) | 0.09 |
| *Fair* | 0.17(0.38) | 0.09(0.29) | -3.97 |
| *Good* | 0.37(0.48) | 0.44(0.50) | 2.17 |
| *Very Good* | 0.38(0.49) | 0.40(0.49) | 0.63 |
| *Excellent* (reference) | 0.05(0.21) | 0.04(0.19) | -0.88 |
| Migrant | 0.29(0.45) | 0.53(0.50) | 7.71 |
| Family Monthly Income | 3,332(3,117) | 2,738(3,811) | -2.48 |
| Insurance | | | |
| *Uninsured* | 0.28(0.45) | 0.57(0.50) | 9.40 |
| *Voluntary* | 0.07(0.25) | 0.05(0.23) | -1.09 |
| *Job-based* (reference) | 0.65(0.49) | 0.37(0.49) | -8.99 |

*Continues...*

Table 4.1 *Continued*

| Variable | State Provider $N_s = 1{,}673$ Mean (S.D.) | Private Provider $N_p = 282$ Mean (S.D.) | $t$-statistic |
|---|---|---|---|
| Employment | | | |
| *Unemployed* | 0.10(0.31) | 0.12(0.33) | 0.93 |
| *Retired* | 0.27(0.44) | 0.18(0.38) | -3.70 |
| *Not Working* | 0.03(0.17) | 0.01(0.12) | -1.78 |
| *Employed* (reference) | 0.62(0.49) | 0.67(0.47) | 1.72 |
| Education | | | |
| *Higher Education* | 0.16(0.37) | 0.09(0.30) | -3.55 |
| *High School* | 0.42(0.49) | 0.36(0.49) | -1.90 |
| *Junior High* | 0.29(0.45) | 0.36(0.48) | 2.15 |
| *Primary Schooling* | 0.10(0.31) | 0.17(0.38) | 2.85 |
| *No Education* (reference) | 0.02(0.15) | 0.02(0.14) | -0.64 |
| Provider Characteristics | | | |
| High-Level Hospital | 0.67(0.48) | 0.11(0.32) | -25.23 |
| Low-Level Hospital | 0.17(0.38) | 0.20(0.40) | 1.24 |
| High-Level Clinic | 0.01(0.11) | 0.01(0.08) | -0.86 |
| Low-Level Clinic (reference) | 0.16(0.35) | 0.68(0.48) | 18.20 |
| Identifying Variables | | | |
| Selection Function | | | |
| *Use of Unnecessary Care* | 0.25(0.44) | 0.23(0.42) | -0.71 |
| Expenditure Functions | | | |
| *Employer Ownership* | 0.47(0.49) | 0.25(0.44) | -7.71 |

Table 4.2: Variables in the Market Share Analysis

| Market Share | Income | Population Health | Health Care Resources |
|---|---|---|---|
| Outpatient Visits | Per Capita Income | Infant Mortality | Hospital Beds/1,000 |
| Hospital Beds | Savings Rate | Maternal Mortality | Physicians/1,000 |
| Medical Equipment | Gini Coefficient | Life Expectancy | General Occupancy Rate |
| Physicians | | ER Death Rate | State Occupancy Rate |
| Doctoral Physicians | | ICU Death Rate | |

Table 4.3: Probit Estimation of the Selection Equation

| Variable | Reduced | Structural | | | | |
|---|---|---|---|---|---|---|
| | Form | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| Identifying Variable | | | | | | |
| State-Owned Employer | 0.373 | | | 0.368 | | |
| | (0.128) | | | (0.132) | | |
| Other Variables | | | | | | |
| Price Gap | — | -0.353 | -0.279 | -0.357 | -0.442 | -0.435 |
| | — | (2.902) | (1.011) | (1.293) | (1.605) | (1.577) |
| Age | 0.004 | -0.024 | -0.0001 | -0.0002 | -0.002 | -0.004 |
| | (0.006) | (0.099) | (0.013) | (0.014) | (0.020) | (0.026) |
| Gender | 0.056 | 0.356 | 0.153 | 0.221 | 0.233 | 0.200 |
| | (0.101) | (1.124) | (0.397) | (0.638) | (0.682) | (0.565) |
| Married | -0.145 | 0.022 | -0.089 | -0.098 | -0.054 | -0.060 |
| | (0.149) | (0.535) | (0.219) | (0.196) | (0.323) | (0.567) |
| Poor Health | -0.642 | -0.950 | -0.947 | -0.867 | -0.714 | -0.978 |
| | (0.355) | (0.739) | (0.727) | (0.502) | (0.433) | (1.562) |
| Fair Health | -0.053 | -0.673 | -0.345 | -0.327 | -0.358 | -0.865 |
| | (0.273) | (2.033) | (0.876) | (0.815) | (0.926) | (0.956) |
| Good Health | -0.468 | -0.936 | -0.749 | -0.741 | -0.826 | -1.056 |
| | (0.242) | (1.185) | (0.546) | (0.524) | (0.804) | (0.447) |
| Very Good Health | -0.126 | -0.226 | -0.309 | -0.286 | -0.256 | -0.378 |
| | (0.241) | (0.265) | (0.383) | (0.328) | (0.278) | (0.270) |
| Higher Education | -0.166 | 0.586 | -0.178 | -0.198 | -0.269 | -0.228 |
| | (0.393) | (2.994) | (0.445) | (0.419) | (0.421) | (0.400) |

*Continues...*

Table 4.3 *Continued*

| Variable | Reduced | Structural | | | | |
|---|---|---|---|---|---|---|
| | Form | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| High-School Education | 0.048 | 0.629 | 0.035 | 0.005 | 0.002 | 0.028 |
| | (0.361) | (2.174) | (0.368) | (0.387) | (0.389) | (0.370) |
| Junior High School | 0.060 | 0.661 | 0.064 | 0.056 | 0.063 | 0.087 |
| | (0.358) | (2.182) | (0.367) | (0.370) | (0.367) | (0.373) |
| Primary School | -0.187 | 0.310 | -0.200 | -0.206 | -0.223 | -0.132 |
| | (0.363) | (2.183) | (0.375) | (0.380) | (0.398) | (0.414) |
| Migrant | -0.200 | 0.147 | -0.216 | -0.132 | -0.196 | -0.175 |
| | (0.139) | (1.154) | (0.210) | (0.195) | (0.174) | (0.144) |
| Poorest 1/5 | 0.427 | 1.344 | 0.540 | 0.576 | 0.639 | 0.568 |
| | (0.163) | (3.656) | (0.798) | (0.854) | (1.109) | (0.854) |
| Next Poorest 1/5 | 0.472 | 0.583 | 0.489 | 0.477 | 0.581 | 0.528 |
| | (0.171) | (0.798) | (0.470) | (0.432) | (0.788) | (0.603) |
| Middle Income | 0.155 | 0.480 | 0.226 | 0.232 | 0.331 | 0.271 |
| | (0.151) | (1.367) | (0.464) | (0.485) | (0.831) | (0.621) |
| Next Richest 1/5 | 0.158 | 1.088 | 0.282 | 0.264 | 0.448 | 0.369 |
| | (0.150) | (3.700) | (0.789) | (0.726) | (1.385) | (1.097) |
| No Insurance | -0.307 | -0.139 | -0.221 | -0.227 | -0.288 | -0.278 |
| | (0.136) | (0.574) | (0.293) | (0.275) | (0.140) | (0.149) |
| Voluntary Insurance | 0.461 | 0.605 | 0.498 | 0.514 | 0.572 | 0.677 |
| | (0.209) | (1.684) | (0.312) | (0.315) | (0.527) | (0.897) |
| Unemployed | 0.042 | 0.757 | 0.114 | 0.136 | 0.163 | 0.201 |
| | (0.170) | (2.557) | (0.282) | (0.347) | (0.434) | (0.561) |
| Retired | -0.194 | 0.672 | -0.202 | -0.027 | -0.049 | -0.040 |
| | (0.181) | (2.941) | (0.467) | (0.442) | (0.374) | (0.400) |

*Continues...*

Table 4.3 *Continued*

| Variable | Reduced | Structural | | | | |
|---|---|---|---|---|---|---|
| | Form | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| Not Working | 0.565 | -0.248 | 0.400 | 0.378 | 0.404 | 0.239 |
| | (0.343) | (2.923) | (0.658) | (0.724) | (0.604) | (1.192) |
| High-Level Hospital | 2.094 | 2.122 | 2.054 | 2.105 | 2.163 | 2.292 |
| | (0.126) | (0.234) | (0.268) | (0.141) | (0.210) | (0.643) |
| Low-Level Hospital | 0.757 | 0.716 | 0.913 | 0.706 | 0.768 | 0.861 |
| | (0.127) | (0.130) | (0.155) | (0.134) | (0.234) | (0.179) |
| High-Level Clinic | 1.543 | 1.548 | 1.629 | 1.724 | 1.923 | 2.158 |
| | (0.419) | (0.422) | (0.505) | (0.748) | (1.408) | (2.235) |
| Unnecessary Care | -0.046 | — | — | — | — | — |
| | (0.116) | — | — | — | — | — |
| *N* | 1,955 | | | 1,572 | | |

Table 4.4: Differences in Estimated Coefficients

| Correction Method | None | Parametric | Differening-Based Semiparametric | | | | |
|---|---|---|---|---|---|---|---|
| | | | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| Age | -0.009 | -0.009 | -0.020 | -0.014 | -0.009 | -0.012 | -0.008 |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) |
| Gender | 0.363 | 0.351 | 0.229 | 0.381 | 0.488 | 0.421 | 0.446 |
| | (0.154) | (0.148) | (0.155) | (0.152) | (0.156) | (0.155) | (0.165) |
| Married | 0.032 | 0.033 | 0.113 | 0.125 | 0.089 | 0.173 | 0.063 |
| | (0.192) | (0.213) | (0.193) | (0.208) | (0.202) | (0.202) | (0.211) |
| Poor Health | -0.174 | -0.191 | -0.133 | -0.521 | -0.259 | 0.136 | -0.184 |
| | (0.560) | (0.592) | (0.556) | (0.618) | (0.574) | (0.844) | (0.471) |
| Fair Health | -0.558 | -0.567 | -0.409 | -0.714 | -0.583 | -0.540 | -0.673 |
| | (0.381) | (0.427) | (0.467) | (0.461) | (0.430) | (0.387) | (0.397) |
| Good Health | -0.345 | -0.379 | -0.236 | -0.441 | -0.350 | -0.473 | -0.396 |
| | (0.314) | (0.380) | (0.382) | (0.402) | (0.389) | (0.376) | (0.315) |
| Very Good Health | -0.040 | -0.058 | 0.002 | -0.265 | -0.143 | -0.048 | -0.129 |
| | (0.316) | (0.380) | (0.380) | (0.410) | (0.387) | (0.303) | (0.315) |
| Higher Education | 0.188 | 0.208 | 0.604 | 0.150 | 0.084 | -0.093 | 0.206 |
| | (0.466) | (0.565) | (0.533) | (0.508) | (0.494) | (0.491) | (0.538) |
| High-School | 0.010 | 0.022 | 0.476 | -0.014 | -0.097 | -0.083 | -0.026 |
| | (0.396) | (0.502) | (0.459) | (0.419) | (0.446) | (0.397) | (0.426) |
| Junior High | 0.095 | 0.108 | 0.477 | 0.035 | -0.036 | -0.013 | 0.032 |
| School | (0.391) | (0.497) | (0.445) | (0.484) | (0.449) | (0.385) | (0.423) |
| Primary School | 0.092 | 0.091 | 0.362 | -0.015 | -0.071 | -0.096 | -0.040 |
| | (0.393) | (0.504) | (0.454) | (0.479) | (0.438) | (0.403) | (0.431) |

*Continues...*

Table 4.4 *Continued*

| Correction Method | None | Parametric | Differencing-Based Semiparametric | | | | |
|---|---|---|---|---|---|---|---|
| | | | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| Migrant | 0.061 | 0.044 | 0.233 | 0.122 | 0.097 | -0.066 | 0.068 |
| | (0.181) | (0.193) | (0.178) | (0.183) | (0.197) | (0.187) | (0.192) |
| Poorest 1/5 | 0.629 | 0.667 | 0.744 | 0.625 | 0.650 | 0.681 | 0.770 |
| | (0.253) | (0.254) | (0.238) | (0.268) | (0.266) | (0.283) | (0.268) |
| Next Poorest 1/5 | 0.334 | 0.373 | 0.170 | 0.367 | 0.311 | 0.482 | 0.379 |
| | (0.252) | (0.269) | (0.247) | (0.239) | (0.262) | (0.284) | (0.288) |
| Middle Income | 0.480 | 0.501 | 0.277 | 0.366 | 0.359 | 0.510 | 0.528 |
| | (0.237) | (0.237) | (0.248) | (0.253) | (0.244) | (0.278) | (0.270) |
| Next Richest 1/5 | 0.665 | 0.762 | 0.753 | 0.597 | 0.550 | 0.855 | 0.649 |
| | (0.234) | (0.239) | (0.222) | (0.253) | (0.255) | (0.265) | (0.262) |
| No Insurance | 0.100 | 0.071 | 0.115 | 0.258 | 0.189 | 0.019 | 0.014 |
| | (0.189) | (0.216) | (0.225) | (0.227) | (0.210) | (0.209) | (0.213) |
| Voluntary Insurance | 0.151 | 0.197 | 0.340 | 0.396 | 0.208 | 0.297 | 0.313 |
| | (0.351) | (0.328) | (0.369) | (0.372) | (0.339) | (0.365) | (0.324) |
| Unemployed | 0.249 | 0.259 | 0.518 | 0.176 | 0.225 | 0.241 | 0.332 |
| | (0.254) | (0.248) | (0.238) | (0.245) | (0.253) | (0.252) | (0.229) |
| Retired | 0.195 | 0.185 | 0.598 | 0.375 | 0.309 | 0.199 | 0.283 |
| | (0.243) | (0.259) | (0.270) | (0.264) | (0.277) | (0.249) | (0.267) |
| Not Working | -0.416 | -0.377 | -0.592 | -0.467 | -0.496 | -0.338 | -0.255 |
| | (0.406) | (0.547) | (0.424) | (0.392) | (0.452) | (0.475) | (0.442) |
| High-Level Hospital | 0.171 | 0.283 | -0.943 | -0.206 | -0.046 | 0.092 | 0.153 |
| | (0.227) | (0.402) | (0.387) | (0.355) | (0.391) | (0.539) | (0.866) |
| Low-Level Hospital | -0.147 | -0.132 | -0.212 | -0.074 | -0.028 | 0.119 | -0.032 |
| | (0.208) | (0.221) | (0.261) | (0.264) | (0.313) | (0.262) | (0.281) |

*Continues...*

Table 4.4 *Continued*

| Correction Method | None | Parametric | Differencing-Based Semiparametric | | | | |
|---|---|---|---|---|---|---|---|
| | | | Order 1 | Order 5 | Order 10 | Order 25 | Order 50 |
| High-Level Clinic | 0.512 | 0.520 | 0.002 | 0.246 | 0.495 | 0.847 | 0.550 |
| | (0.303) | (0.752) | (0.673) | (0.595) | (0.615) | (0.467) | (0.586) |
| Unnecessary Care | 0.096 | 0.082 | 0.024 | 0.096 | 0.089 | 0.072 | 0.073 |
| | (0.171) | (0.165) | (0.160) | (0.174) | (0.175) | (0.192) | (0.194) |
| Inverse Mill's Ratios | | | | | | | |
| State Sample | — | -0.381 | — | — | — | — | — |
| | — | (0.321) | — | — | — | — | — |
| Private Sample | — | -0.261 | — | — | — | — | — |
| | — | (0.275) | — | — | — | — | — |
| Adjusted $R^2$ | 0.217 | 0.218 | 0.188 | 0.162 | 0.160 | 0.163 | 0.163 |
| $N$ | | | | 1,572 | | | |
| Specification Tests | | | | | | | |
| *No Correction* | | | | | | | |
| State Sample | — | — | 4.29 | 7.46 | 5.21 | 10.22 | 15.73 |
| Private Sample | — | — | 3.16 | 1.08 | 1.98 | 5.08 | 25.52 |
| *Parametric* | | | | | | | |
| State Sample | — | — | 3.70 | 4.65 | -3.36 | 6.87 | 9.32 |
| Private Sample | — | — | 2.51 | -1.33 | 1.53 | -4.87 | 11.36 |

Note: The specification tests test the semiparametric models against the nulls that (1) no correction is needed; and (2) the parametric model is correct. The test statistic is:

$$\sqrt{mn}(S^2_{null} - S^2_{diff})/S^2_{diff},$$

where $S^2_{null}$ and $S^2_{diff}$ are the sums of squared errors obtained under the null and the semiparametric alternative, respectively. $m$ is the order of differencing and $n$ the number of observations in the sub-sample. The statistic is asymptotically distributed as $N(0, 1)$.

Table 4.5: Semiparametric Estimation for Key Socioeconomic Indicators

| | Order 1 | | Order 5 | | Order 10 | | Order 25 | | Order 50 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | State | Private | State | Private | State | Private | State | Private | State | Private |
| Migrant | 0.103 | -0.130 | 0.118 | -0.007 | 0.130 | 0.032 | 0.104 | 0.045 | 0.096 | 0.028 |
| | (0.091) | (0.167) | (0.090) | (0.190) | (0.090) | (0.177) | (0.090) | (0.176) | (0.090) | (0.177) |
| Income | | | | | | | | | | |
| Poorest 1/5 | -0.362 | -1.111 | -0.348 | -0.972 | -0.318 | -0.968 | -0.351 | -1.104 | -0.328 | -1.098 |
| | (0.123) | (0.224) | (0.124) | (0.250) | (0.124) | (0.240) | (0.124) | (0.240) | (0.121) | (0.252) |
| Next Poorest 1/5 | -0.373 | -0.543 | -0.291 | -0.632 | -0.251 | -0.562 | -0.274 | -0.703 | -0.260 | -0.639 |
| | (0.129) | (0.238) | (0.129) | (0.238) | (0.125) | (0.235) | (0.125) | (0.235) | (0.122) | (0.244) |
| Middle Income | -0.228 | -0.511 | -0.170 | -0.549 | -0.143 | -0.502 | -0.150 | -0.610 | -0.123 | -0.651 |
| | (0.090) | (0.228) | (0.089) | (0.233) | (0.090) | (0.221) | (0.090) | (0.221) | (0.089) | (0.231) |
| Next Richest 1/5 | -0.161 | -0.923 | -0.145 | -0.742 | -0.134 | -0.583 | -0.136 | -0.759 | -0.117 | -0.766 |
| | (0.083) | (0.207) | (0.086) | (0.240) | (0.085) | (0.236) | (0.086) | (0.236) | (0.086) | (0.238) |
| Insurance | | | | | | | | | | |
| No Insurance | 0.193 | 0.078 | 0.117 | -0.140 | 0.079 | -0.110 | 0.129 | 0.110 | 0.085 | 0.070 |
| | (0.111) | (0.213) | (0.112) | (0.211) | (0.109) | (0.194) | (0.109) | (0.194) | (0.107) | (0.196) |
| Voluntary Insurance | -0.122 | -0.432 | -0.036 | -0.432 | -0.023 | -0.418 | -0.023 | -0.325 | 0.014 | -0.299 |
| | (0.124) | (0.354) | (0.132) | (0.346) | (0.115) | (0.334) | (0.115) | (0.334) | (0.105) | (0.345) |
| Employment | | | | | | | | | | |
| Unemployed | 0.086 | -0.430 | 0.029 | -0.143 | 0.016 | -0.209 | 0.013 | -0.303 | 0.016 | -0.320 |
| | (0.096) | (0.206) | (0.100) | (0.217) | (0.100) | (0.243) | (0.100) | (0.243) | (0.102) | (0.261) |
| Retired | 0.122 | -0.470 | -0.023 | -0.397 | -0.024 | -0.334 | -0.014 | -0.326 | -0.015 | -0.303 |
| | (0.100) | (0.253) | (0.101) | (0.251) | (0.104) | (0.254) | (0.104) | (0.254) | (0.105) | (0.261) |
| Not Working | 0.129 | 0.726 | 0.211 | 0.679 | 0.252 | 0.749 | 0.237 | 0.508 | 0.249 | 0.503 |
| | (0.224) | (0.372) | (0.231) | (0.459) | (0.207) | (0.366) | (0.207) | (0.366) | (0.213) | (0.350) |
| Unnecessary Care | 0.394 | 0.370 | 0.371 | 0.257 | 0.347 | 0.257 | 0.336 | 0.235 | 0.329 | 0.300 |
| | (0.066) | (0.145) | (0.064) | (0.159) | (0.066) | (0.162) | (0.067) | (0.166) | (0.069) | (0.195) |

Table 4.6: Andews-Schafgans Intercept Estimates

| | None | | Para-metric | | Order 1 | | Order 5 | | Order 10 | | Order 25 | | Order 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | State | Private | State | Private | State | Private | State | Private | State | Private | State | Private | State | Private |
| | 5.24 | 4.58 | 5.65 | 4.57 | — | — | — | — | — | — | — | — | — | — |
| | (0.38) | (0.68) | (0.50) | (0.81) | — | — | — | — | — | — | — | — | — | — |
| *Semiparametric Bandwidth Choice* | | | | | | | | | | | | | | |
| 2.5% | — | — | — | — | 6.18 | 4.09 | 6.09 | 3.67 | 5.98 | 3.88 | 6.05 | 3.35 | 5.92 | 3.71 |
| | — | — | — | — | (0.23) | (0.08) | (0.23) | (0.05) | (0.23) | (0.07) | (0.23) | (0.03) | (0.23) | (0.05) |
| 5% | — | — | — | — | 6.07 | 4.52 | 5.98 | 4.13 | 5.86 | 4.34 | 5.91 | 3.80 | 5.80 | 4.16 |
| | — | — | — | — | (0.16) | (0.22) | (0.16) | (0.21) | (0.16) | (0.23) | (0.16) | (0.20) | (0.16) | (0.20) |
| 10% | — | — | — | — | 5.97 | 4.55 | 5.88 | 4.20 | 5.75 | 4.42 | 5.80 | 3.89 | 5.70 | 4.24 |
| | — | — | — | — | (0.11) | (0.20) | (0.11) | (0.20) | (0.11) | (0.21) | (0.12) | (0.19) | (0.12) | (0.19) |
| 20% | — | — | — | — | 5.94 | 4.52 | 5.85 | 4.20 | 5.73 | 4.43 | 5.78 | 3.92 | 5.69 | 4.26 |
| | — | — | — | — | (0.08) | (0.16) | (0.08) | (0.16) | (0.08) | (0.16) | (0.08) | (0.15) | (0.08) | (0.15) |

Table 4.7: Estimated Public-Private Price Gap

| | | | | | |
|---|---|---|---|---|---|
| No Correction | | | 9.2% | | |
| | | | (2.28) | | |
| Parametric Estimation | | | 91.6% | | |
| | | | (4.07) | | |
| Semiparametric | | *% of Sample Used in Intercept Estimation* | | | |
| Estimation | | 2.5% | 5% | 10% | 20% |
| | Order 1 | 246% | 103% | 77% | 78% |
| | | (1.86) | (1.70) | (1.79) | (1.79) |
| *Order* | Order 5 | 322% | 137% | 100% | 99% |
| | | (1.30) | (1.26) | (1.25) | (1.25) |
| *of* | Order 10 | 326% | 139% | 99% | 92% |
| | | (1.28) | (1.25) | (1.24) | (1.24) |
| *Differencing* | Order 25 | 426% | 246% | 184% | 168% |
| | | (1.52) | (1.48) | (1.48) | (1.48) |
| | Order 50 | 428% | 200% | 149% | 139% |
| | | (1.29) | (1.25) | (1.23) | (1.23) |

Table 4.8: Public-Private Price Gap for Various Socioeconomic Groups

| Socioeconomic | Income | | Residence | | Employment | | Insurance | |
|---|---|---|---|---|---|---|---|---|
| Indicator | *Poor* | *Rich* | *Migrant* | *Local* | *Jobless* | *Employed* | *No* | *Yes* |
| Order 1 | | | | | | | | |
| *5% of Sample* | 180% | -16% | 170% | 65% | 65% | 121% | 164% | 59% |
| | (2.42) | (1.99) | (2.42) | (2.19) | (2.35) | (2.33) | (2.09) | (2.30) |
| *10% of Sample* | 140% | -17% | 135% | 43% | 43% | 92% | 129% | 38% |
| | (2.46) | (1.98) | (2.23) | (2.19) | (2.26) | (2.32) | (2.08) | (2.29) |
| *20% of Sample* | 143% | -16% | 137% | 45% | 45% | 94% | 132% | 40% |
| | (2.46) | (1.98) | (2.23) | (2.19) | (2.27) | (2.32) | (2.08) | (2.29) |
| Order 5 | | | | | | | | |
| *5% of Sample* | 211% | 18% | 203% | 106% | 98% | 160% | 206% | 96% |
| | (1.94) | (1.64) | (1.72) | (1.82) | (1.69) | (1.86) | (1.63) | (1.89) |
| *10% of Sample* | 163% | -0.3% | 156% | 73% | 67% | 119% | 158% | 65% |
| | (1.93) | (1.63) | (1.71) | (1.82) | (1.67) | (1.86) | (1.62) | (1.88) |
| *20% of Sample* | 160% | -1% | 154% | 73% | 66% | 117% | 156% | 64% |
| | (1.93) | (1.63) | (1.71) | (1.82) | (1.67) | (1.86) | (1.62) | (1.88) |
| Order 10 | | | | | | | | |
| *5% of Sample* | 210% | 23% | 197% | 111% | 107% | 158% | 199% | 102% |
| | (1.86) | (1.46) | (1.60) | (1.64) | (1.57) | (1.70) | (1.54) | (1.68) |
| *10% of Sample* | 158% | 3% | 147% | 75% | 72% | 115% | 149% | 68% |
| | (1.93) | (1.45) | (1.59) | (1.64) | (1.55) | (1.86) | (1.53) | (1.68) |
| *20% of Sample* | 150% | -1% | 139% | 70% | 66% | 108% | 140% | 62% |
| | (1.84) | (1.45) | (1.59) | (1.64) | (1.54) | (1.70) | (1.53) | (1.68) |

Note: The comparison groups on the metric of income are individuals whose household income is in the lowest and the highest quintile, respectively, of each city's income distribution.

Table 4.9: Median Market Share Coefficients

| | Outpatient Visits | Hospital Beds | Equipment | Physicians | High-Education Physicians |
|---|---|---|---|---|---|
| Individual Cost | -0.12 | 0.15 | 0.02 | -0.13 | -0.13 |
| | (-2.90) | (1.90) | (1.33) | (-3.74) | (-4.09) |
| Price Gap | -0.06 | 0.04 | -0.01 | -0.03 | -0.10 |
| | (-2.07) | (-1.03) | (-1.55) | (-3.03) | (-4.75) |

Note: The numbers in parentheses are the $t$ statistics.

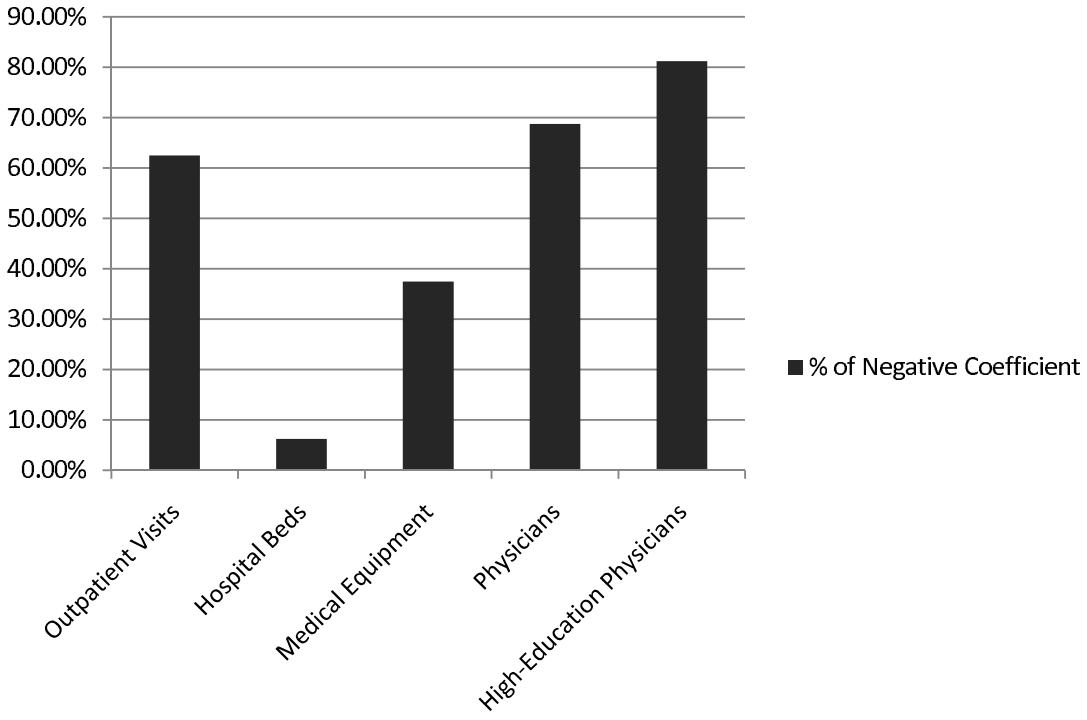


Figure 4.1: Market Liberalization & Price of Care

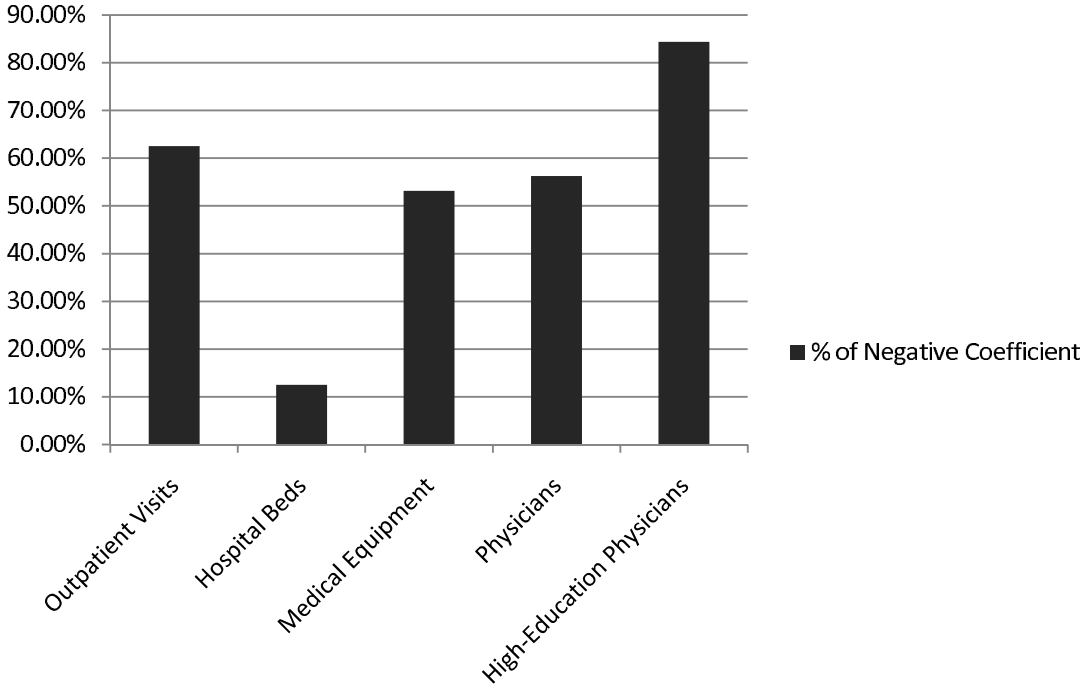


Figure 4.2: Market Liberalization & Price Gap

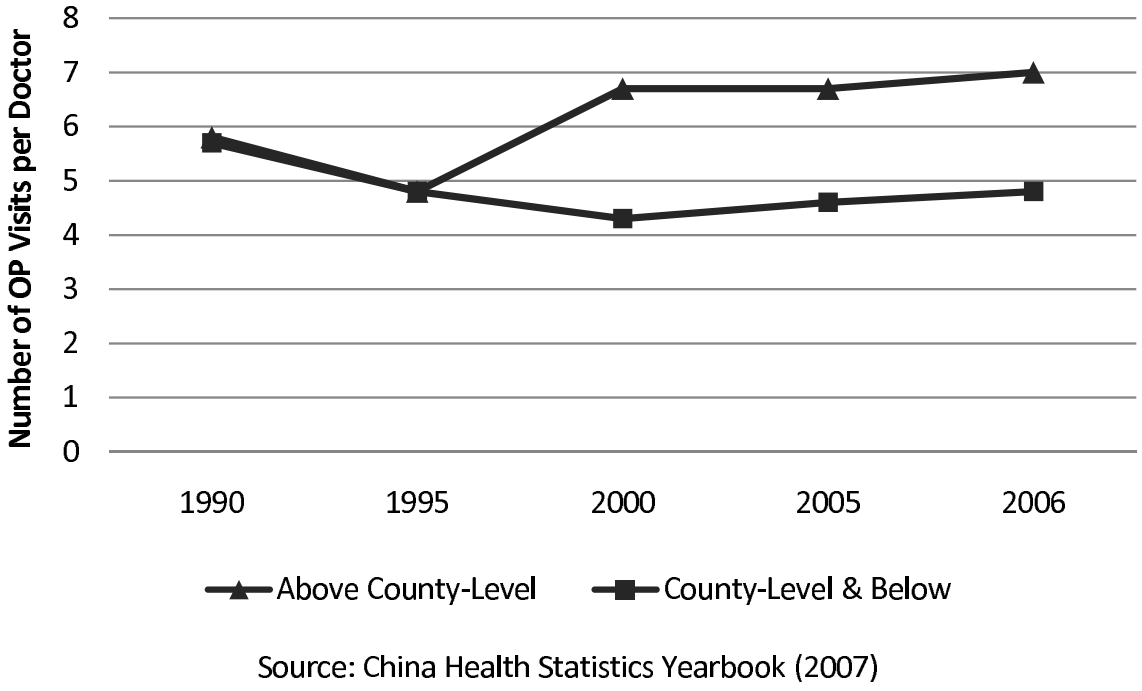


Figure 4.3: Physician Work Load

# 5.0 CONCLUDING REMARKS

My dissertation studies two supply-side issues in the context of China's health care system: (1) the impact of global budgeting on provider behavior; and (2) the role of the market in the delivery of health care services. The two chapters on the global budget policy investigate its adverse effects on special patient groups from both theoretical and empirical perspectives. They find that the cost-saving pressure created by global budgeting could induce providers to avoid insured or high-cost patients, shift costs to the uninsured or skimp on the intensity of services for costly patients. The third chapter compares the price of care between the public and the private health sectors in urban China. It finds that services are not only much more expensive in the state sector, but more expensive to a larger degree for disadvantaged social groups than for the well-off. In addition, liberalizing the market for medical personnel appears to be an effective mechanism for narrowing the public-private price gap as well as for lowering the average cost of care.

All the three studies address the key institutional characteristics of China's health care system. In particular, the policy of fee regulation has given rise to unique definitions or model specifications that (1) in the case of Chapter 2, determine the study's departures from the literature; or (2) in the case of Chapter 4, play a crucial role in the interpretation of the results.

The findings of the dissertation have important implications for China's health system reform. In the case of the global budget policy, provider responses to this policy will determine the real outcome of supply-side cost-saving measures. If hospitals dump patients or skimp on their treatment, the goal of cost containment is achieved only at the expense of

reduced access and quality for certain patient groups, especially those with severe medical conditions. In addition, cost shifting, whether among patient groups or services, will compromise the objective of cost containment as prepayment will have little effect on the total expenditure. Knowledge of these behavioral changes is necessary for finding ways to counter perverse provider responses to global budgeting.

The study of the urban hospital care market suggests that there is considerable room for government policies to increase social welfare. The lack of information on the quality of private hospitals may have discouraged patients from selecting providers on the basis of price. The substantial public-private price gap may thus arise from the public providers' rent-seeking behavior as they exploit their superior market status. In addition, since the gap is larger for disadvantaged social groups, the government may wish to narrow the gap for these patients out of equity concerns. Policies that facilitate the growth of low-cost private institutions or allow for pricing flexibility within the state sector may considerably increase social welfare. Our results regarding private provider market shares indicate that an effective mechanism is to liberalize China's market for medical personnel. By employing well-trained physicians, nurses or managers, private providers can send a credible signal of the quality of their services. This will help dispel the uncertainty around the quality of private hospitals and, consequently, foster market competition on price.

More importantly, our study underscores the importance of research on the role of the market in health care delivery. There has been a tendency in recent policy discussions to ascribe the problems of China's health system to an "unfettered market approach"[1] and to call for public investment that will supposedly supplant financial motives. Our research suggests that this denial of the market may be as misguided as the earlier embrace of incentivization that took hold of China's health system in the 1980s. As I discussed in the opening remarks, the Chinese system is characterized by a mixture of strong market and regulatory incentives. Some of them (e.g., financial incentives on the organizational and the individual level) may have transpired with others (e.g., the regulated fee schedule that biases prescription toward

[1]For instance, see Hsiao (2008)[60].

expensive services and the policies that discourage the growth of the private health sector) to create perverse outcomes. What seems to be an appropriate policy approach is to find the balance between the market and the government that will help obtain efficiency in health care delivery.

## BIBLIOGRAPHY


[1] Ai, C. & E. Norton (2000), "Standard Errors for the Retransformation Problem with Heteroscedasticity," *Journal of Health Economics* 19(5):697-718.

[2] ——— (2008), "A Semiparametric Derivative Estimator in Log Transformation Models," *Econometrics Journal* 11(3): 538-553.

[3] Amemiya, T. (1985), "Advanced Econometrics," Cambridge: Harvard University Press.

[4] Andrews, D. & M. Schafgans (1998), "Semiparametric Estimation of the Intercept of a Sample Selection Model," *Review of Economic Studies* 65(3): 497-517.

[5] Arrow, K. (1963), "Uncertainty and the Welfare Economics of Medical Care," *American Economic Review* 53(5): 941-973.

[6] Ash, A., F. Porell, L. Gruenberg, E. Sawitz & A. Beiser (1989), "Adjusting Medicare Capitation Payments Using Prior Hospitalization Data," *Health Care Financing Review* 10(4): 17-29.

[7] Barros, P. (2003), "Cream-Skimming, Incentives for Efficiency and Payment System," *Journal of Health Economics* 22(3): 419-443.

[8] Bertrand, M., E. Duflo & S. Mullainathan (2004), "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics* 119(1): 249-275.

[9] * Bian, Y., N. Zhuang, Q. Meng & S. Yu (2002), "Cost and Efficiency of Use of PET," *Chinese Journal of Health Economics* (*Zhongguo Weisheng Jingji*) 2002(8): 15-17.

[10] Bloom, G. (2004), "China in Transition: Challenges to Urban Health Services," in G. Bloom & S. Tang, ed., *Health Care Transition in Urban China* (Ashgate), Chapter 1.

[11] Brown R., D. Clement, J. Hill, S. Retchin & J. Bergeron (1993), "Do Health Maintenance Organizations Work for Medicare?," *Health Care Financing Review* 15(1): 7-23.

[12] * Cai, W., M. Ma & W. Zhu (2000), "Exploring the Cost Control Mechanisms Associated with the Integration of Global Budget and Individual Payment," *Health Economics Research* (*Weisheng Jingji Yanjiu*) 19(4): 20-24.

[13] * Cao, J. & K. Yu (2004), "A Comparative Analysis of the Impact of the Basic Health Insurance Policy on Hospitals of Different Level and Type," *Chinese Hospital Management* (*Zhongguo Yiyuan Guanli*) 24(7): 28-30.

[14] * Center for Health Statistics and Information, Ministry of Health (2004), "An Analysis Report of National Health Services Survey in 2003 (Zhongguo Weisheng Fuwu Diaocha Yanjiu: Di San Ci Guojia Weisheng Fuwu Diaocha Fenxi Baogao)," Peking Union Medical University Publishing House (Zhongguo Xiehe Yike Daxue Chubanshe).

[15] Cheng, T. (2008), "China's Latest Health Reforms: A Conversation with Chinese Health Minister Chen Zhu," *Health Affairs* 27(4): 1103-1110.

[16] * *China Health Yearbook* Editorial Board (2004), "China Health Yearbook (Zhongguo Weisheng Nianjian)," People's Medical Publishing House (Renmin Weisheng Chubanshe).

[17] * *China Statistical Yearbook* Editorial Board (2001, 2004), "China Statistical Yearbook (Zhongguo Tongji Nianjian)," China Statistics Press (Zhongguo Tongji Chubanshe).

[18] * Department of Population & Employment Statistics, National Bureau of Statistics of China, & Department of Financial Planning, Ministry of Human Resources & Social Security of China (2001, 2004), "China Labor Statistical Yearbook (Zhongguo Laodong Tongji Nianjian)," China Statistics Press (Zhongguo Tongji Chubanshe).

[19] * Development Research Center (2005), "Comments and Suggestions on the Structural Reform of the Health Care System in China (Dui Zhongguo Yiliao Weisheng Tizhi Gaige De Pingjia Yu Jianyi)," State Council Development Research Center Policy Report (Guowuyuan Fazhan Yanjiu Zhongxin Zhengce Baogao).

[20] Devereaux, P., P. Choi, C. Lacchetti, B. Weaver, H. Schnemann, T. Haines, J. Lavis, B. Grant, D. Haslam, M. Bhandari, T. Sullivan, D. Cook, S. Walter, M. Meade, H. Khan, N. Bhatnagar & G. Guyatt (2002), "A Systematic Review and Meta-Analysis of Studies Comparing Mortality Rates of Private For-Profit and Private Not-For-Profit Hospitals," *Canadian Medical Association Journal* 166(11): 1399-1406.

[21] Docteur, E. & H. Oxley (2003), "Health-Care System: Lessons from the Reform Experience," OECD Health Working Paper.

[22] Dong, W. (2001), "Health Care Reform in Urban China," Working Paper, Comparative Program on Health and Society, Munk Center for Internationl Studies at the University of Toronto.

[23] Dran, J. & B. Campbell (1981), "Hospital Investment and Medicare Reimbursement," *Journal of Financial Research* 4(2):147-160.

[24] Dranove, D. (1987), "Pricing by Non-Profit Institutions: The Case of Hospital Cost-Shifting," *Journal of Health Economics* 7(1): 47-57.

[25] Dranove, D. & M. Satterthwaite (1998), "Monopolistic Competition When Price and Quality are not Perfectly Observed,," *RAND Journal of Economics* 23(4): 518-534.

[26] ——— (2000), "The Industrial Organization of Health Care Markets," in A. Culyer & J. Newhouse ed., *Handbook of Health Economics* (Elsevier North-Holland), Chapter 20.

[27] Dranove, D., M. Shanley & W. White (1993), "Price and Concentration in Hospital Markets: The Switch from Patient-Driven to Payer-Driven Competition," *Journal of Law & Economics* 36(1): 179-204.

[28] Dranove, D. & W. White (1998), "Medicaid-Dependent Hospitals and Their Patients: How Have They Fared?," *Health Services Research* 33(2): 163-186.

[29] Duan, N. (1983), "Smearing Estimate: A Nonparametric Retransformation Method," *Journal of the American Statistical Association* 78(383): 605-610.

[30] Duggan, M. (2000), "Hospital Ownership and Public Medical Spending," *Quarterly Journal of Economics* 115(4): 1343-1373.

[31] ——— (2002), "Hospital Market Structure and the Behavior of Not-for-Profit Hospitals," *RAND Journal of Economics* 33(3): 433-446.

[32] Eggleston, K. (2000), "Risk Selection and Optimal Health Insurance-Provider Payment Systems," *Journal of Risk & Insurance* 67(2): 173-196.

[33] Eggleston, K. & W. Yip (2001), "Provider Response to Prospective Hospital Payment in Hainan Province in the People's Republic of China," *Health Economics* 10(4):325-339.

[34] ——— (2004), "Addressing Government and Market Failures with Payment Incentives: Hospital Reimbursement Reform in Hainan, China," *Social Science & Medicine* 58(2): 267-277.

[35] Eggleston, K., L. Li, Q. Meng, M. Lindelow & A. Wagstaff (2008a), "Health Service Delivery in China: A Literature Review," *Health Economics* 17(2): 149-165.

[36] Eggleston, K., J. Wang & K. Rao (2008b), "From Plan to Market in the Health Sector? China's Experience," *Journal of Asian Economics* 19(5-6): 400-412.

[37] Eggleston, K., M. Liu, J. Wang, C. Li, Z. Yang & J. Zhang (2009), "Comparing Public and Private Hospitals in China: Evidence from Guangdong Province," Stanford University ARPAC Asia Health Policy Program Working Paper No. 7.

[38] Ellis, R. (1998), "Creaming, Skimping and Dumping: Provider Competition on the Intensive and Extensive Margins," *Journal of Health Economics* 17(5): 537-555.

[39] Ellis, R. & T. McGuire (1993), "Supply-Side and Demand-Side Cost Sharing in Health Care," *Journal of Economic Perspectives* 7(4): 135-151.

[40] ——— (1996), "Hospital Response to Prospective Payment: Moral Hazard, Selection, and Practice-Style Effects," *Journal of Health Economics* 15(3): 257-277.

[41] Fan, C., K. Chen & K. Kan (1998), "The Design of Payment Systems for Physicians under Global Budget — An Experimental Study," *Journal of Economic Behavior & Organization* 34(2): 295-311.

[42] Feldstein, P. (1993), Health Care Economics, Delmar Publishers.

[43] Foster, R. (1985), "Cost-Shifting under Cost Reimbursement and Prospective Payment," *Journal of Health Economics* 4(3): 261-271.

[44] Frank, R. & D. Salkever (1991), "The Supply of Charity Services by Nonprofit Hospitals: Motives and Market Structure," *RAND Journal of Economics* 22(3): 430-445.

[45] Fuchs, V. (1978), "The Supply of Surgeons and the Demand for Operations," *Journal of Human Resources* 13(Suppl): 35-56.

[46] Gao, J., S. Tang, R. Tolhurst & K. Rao (2001), "Changing Access to Health Services in Urban China: Implications for Equity?," *Health Policy & Planning* 16(3): 302-312.

[47] Glaeser, E. & A. Shleifer (2001), "Not-for-Profit Entrepreneurs," *Journal of Public Economics* 81(1): 99-115.

[48] Grabowski, H. & J. Vernon (1992), "Brand Loyalty, Entry and Price Competition in Pharmaceuticals after the 1984 Drug Act," *Journal of Law & Economics* 35(2): 331-350.

[49] * Guan, W., "Some Thoughts and Suggestions for the Development of Private Hospitals," *Chinese Hospitals (Zhongguo Yiyuan)* 5: 50-51.

[50] Hadley, J. & J. Feder (1985), "Hospital Cost Shifting and Care for the Uninsured," *Health Affairs* 4(3): 67-80.

[51] Hamilton, B. (2002), "HMO Selection and Medicare Costs: Bayesian MCMC Estimation of a Robust Panel Data Tobit Model with Survival," in A. Jones & O. O'Donnell ed., *Econometric Analysis of Health Data* (John Wiley and Sons), Chapter 16.

[52] Hansmann, H. (1980), "The Role of Nonprofit Enterprise," *Yale Law Journal* 89(5): 835-901.

[53] Hay, J. (1983), "The Impact of Public Health Care Financing Policies on Private Sector Hospital Costs," *Journal of Health Politics, Policy & Law* 7(4): 945-952.

[54] Heckman, J. (1979), "Sample Selection as a Specification Error," *Econometrica* 47(1): 153-161.

[55] ——— (1980), "Addendum to Sample Selection Bias as a Specification Error," in E. Stromsdorfer & G. Farkas, ed., *Evaluation Studies Review Annual*, Vol. 5 (Sage Press).

[56] Heckman, J., H. Ichimura, J. Smith & P. Todd (1998), "Characterizing Selection Bias Using Experimental Data," *Econometrica* 66(5): 1017-1098.

[57] Health Insurance Association of America (1982), "Hospital Cost Shifting: The Hidden Tax," HIAA, Wahsington, D.C.

[58] Hill, J. & R. Brown (1990), "Biased Selection in the TEFRA HMO/CMP Program," Mathematica Policy Research Working Paper No. 7786-503, Princeton University.

[59] Hsiao, W. (1995), "The Chinese Health Care System: Lessons for Other Nations," *Social Science & Medicine* 41(8): 1047-1055.

[60] ——— (2008), "When Incentives and Professionalism Collide," *Health Affairs* 27(4): 949-951

[61] Hsueh, Y., S. Lee & Y. Huang (2004), "Effects of Global Budgeting on the Distribution of Dentists and Use of Dental Care in Taiwan," *Health Services Research* 39(6): 2135-2153.

[62] * Hu, A. (1999), "The Biggest Adjustment for Entering the New Century: China Enters a Period of High Unemployment (Jinru Xin Shiji De Zuida Tiaozheng: Zhongguo Jinru Gao Shiye Qi)," in *Analytical Report on the State of Country for China (Zhongguo Guoqing Fenxi Yanjiu Baogao)*, Chinese Academy of Sciences and Tsinghua University (Zhongguo Kexueyuan Yu Qinghua Daxue).

[63] Hussain, A. (2003), "Urban Poverty in China: Measurement, Patterns and Policies," InFocus Programme on Socio-Economic Security, International Labour Organization, Geneva.

[64] Jamison, D., J. Breman, A. Measham, G. Alleyne, M. Claeson, D. Evans, P. Jha, A. Mills & P. Musgrove (2006), "Cost-Effective Strategies for the Excess Burden of Disease in Developing Countries," *Priorities in Health*, New York: Oxford University Press.

[65] Jones, A. (2000), "Health Econometrics," in A. Cuyler & J. Newhouse ed., *Handbook of Health Economics* (Elsevier North-Holland), Chapter 6.

[66] Kessler, D. & M. McClellan (2000), "Is Hospital Competition Socially Wasteful?," *Quarterly Journal of Economics* 115(2): 577-615.

[67] Lakdawalla, D. & T. Philipson (1998), "Nonprofit Production and Competition," NBER Working Paper No. 6377.

[68] Lei, X. & W. Lin (2009), "The New Cooperative Medical Scheme in Rural China: Does More Coverage Mean More Service and Better Health?," *Health Economics* 18(2): S25-S46.

[69] Leonard K., M. Rauner, M. Schaffhauser-Linzatti & R. Yap (2003), "The Effect of Funding Policy on Day of Week Admissions and Discharges in Hospitals: The Cases of Austria and Canada," *Health Policy* 63(3): 239-257.

[70] * Li, W. & W. Song (2002), "A Practical Analysis of the Hospital Property Rights System" *Chinese Health Economics (Zhongguo Weisheng Jingji)* 21(3): 1-5.

[71] Lim, M., H. Yang, T. Zhang, W. Feng, Z. Zhou & Y. Chen (2002), "The Role and Scope of Private Medical Practice in China," Word Bank Working Paper.

[72] Lim, M., H. Yang, T. Zhang, W. Feng & Z. Zhou (2004), "Public Perceptions of Private Health Care in Socialist China," *Health Affairs* 23(6): 222-234.

[73] * Lin, F., M. Qiu & S. Zhang (2004), "Exploring the Medical Insurance Payment Method in Zhenjiang," *Chinese Health Economics (Zhongguo Weisheng Jingji)* 23(9): 37.

[74] * Lin, Q. (2004), "Adjustment of Payment Methods for Urban Health Insurance Schemes," *Chinese Advanced Hospital Management (Zhongguo Gaoji Yiyuan Guanli)* 7: 23-25.

[75] Liu, G., P. Yuen, T. Hu, L. Li & X. Liu (2003), "Urban Health Insurance Reform: What Can we Learn from the Pilot Experiments?" in A. Chen *et al.* ed., *Urbanization and Social Welfare in China* (Ashgate Publishing).

[76] Liu, X. & W. Hsiao (1995), "The Cost Escalation of Social Health Insurance Plan in China: Its Implication for Public Policy," *Social Science & Medicine* 41(8): 1095-1101.

[77] Liu, X., Y. Liu & N. Chen (2000), "The Chinese Experience of Hospital Price Regulation," *Health Policy & Planning* 15(2): 157-163.

[78] Liu, X. & A. Mills (2003), "The Influence of Bonus Payments to Doctors on Hospital Revenue: Results of a Quasi-experimental Study," *Applied Health Economics & Health Policy*, 2(2): 91-98.

[79] Liu, Y. (2002), "Reforming China's Urban Health Insurance System," *Health Policy* 60(2): 133-150.

[80] Manning, W. (1998), "The Logged Dependent Variable, Heteroskedasticity, and the Retransformation Problem," *Journal of Health Economics* 17(3): 283-295.

[81] Manning, W. & J. Mullahy (2001), "Estimating Log Models: To Transform or Not To Transform?" *Journal of Health Economics* 20(4): 461-494.

[82] Meltzer D., J. Chung & A. Basu (2002), "Does Competition under Medicare Prospective Payment Selectively Reduce Expenditures on High-Cost Patients?," *RAND Journal of Economics* 33(3): 447-468.

[83] * Meng, Q. (2002), "The Impact of Provider Payment Reforms on Cost Containment," *Chinese Health Economics Research (Zhonghua Weisheng Jingji Yanjiu)* 9: 18-20.

[84] * Meng, Q., Y. Bian & Q. Sun (2002), "Improving the Pricing System for Health Care (I)," *Chinese Journal of Health Economics (Zhongguo Weisheng Jingji)* 2002(5): 31-34.

[85] Meng, Q., X. Liu & J. Shi (2000), "Comparing the Services and Quality of Private and Public Clinics in Rural China", *Health Policy & Planning* 15(4): 349-356.

[86] Meng, Q., C. Rehnberg, N. Zhuang, Y. Bian, T. Goran & S. Tang (2004), "The Impact of Urban Health Insurance Reform on Hospital Charges: A Case Study from Two Cities in China," *Health Policy* 68(2): 197-209.

[87] Meng, Q. & S. Tang (2004), "Introduction to the Urban Health System and Review of Reform Initiatives," in G. Bloom & S. Tang, ed., *Health Care Transition in Urban China* (Ashgate), Chapter 2.

[88] * Ministry of Health (2003), "Chinese Health Statistical Digest (Zhongguo Weisheng Tongji Tiyao)," China Statistics Press (Zhongguo Tongji Chubanshe).

[89] * ——— (2000, 2004, 2005, 2006, 2007, 2008), "China Health Statistics Yearbook (Zhongguo Weisheng Tongji Nianjian)," Peking Union Medical University Publishing House (Zhongguo Xiehe Yike Daxue Chubanshe).

[90] Morgan, R., B. Vernig, C. DeVito & N. Persily (1997), "The Medicare-HMO Revolving Door: The Healthy Go In and the Sick Go Out," *New England Journal of Medicine* 337(3): 169-175.

[91] Morrisey, M. (1996), "Hospital Cost Shifting: A Continuing Debate," *EBRI Issue Brief* No. 180.

[92] Mougeot, M. & F. Naegelen (2005), "Hospital Price Regulation and Expenditure Cap Policy," *Journal of Health Economics* 24(1): 55-72.

[93] Newhouse, J. (1970), "Toward a Theory of Nonprofit Institutions: An Economic Model of a Hospital," *American Economic Review* 60(1): 60-74.

[94] ——— (1989), "Do Unprofitable Patients Face Access Problems?," *Health Care Financing Review* 11(2): 33-42.

[95] ——— (1996), "Reimbursing Health Plans and Health Providers: Efficiency in Production Versus Selection," *Journal of Economic Literature* 34(3): 1236-1263.

[96] Newhouse, J., E. Sloss, W. Manning & E. Keeler (1993), "Risk Adjustment for A Children's Capitation Rate," *Health Care Financing Review* 15(1): 39-54.

[97] Paddock, S., J. Escarce, H. Orla & B. Beeuwkes (2007), "Did the Medicare Inpatient Rehabilitation Facility Prospective Payment System Result in Changes in Relative Patient Severity and Relative Resource Use?," *Medical Care* 45(2):123-130.

[98] Pagan, A. & F. Vella (1989), "Diagnostic Tests for Models Based on Individual Data: A Survey," *Journal of Applied Econometrics* 4: S29-S59.

[99] Pauly, M. & M. Redisch (1973), "The Not-for-Profit Hospital as a Physicians' Cooperative," *American Economic Review* 63(1): 87-99.

[100] * Peking University Research Team (2002), "The Function and Scope of Private Practice in Health Sector in China," *Hospital Management (Yiyuan Guanli)* 3: 4-6.

[101] Polsky, D. & S. Nicholson (2004), "Why Are Managed Care Plans Less Inexpensive: Risk Selection, Utilization, or Reimbursement?," *Journal of Risk & Insurance* 71(1): 21-40.

[102] Poterba, J. (1994), "A Skeptic's View of Global Budget Caps," *Journal of Economic Perspectives* 8(3): 67-73.

[103] Rehnberg, C., Q. Meng, Y. Bian, N. Zhuang & S. Tang (2004), "The Impact of Health Insurance Reform on Hospital Charges: A Comparison of Nantong and Zibo," in G. Bloom & S. Tang, ed., *Health Care Transition in Urban China* (Ashgate), Chapter 10.

[104] Robinson, J. & H. Luft (1985), "The Impact of Hospital Market Structure on Patient Volume, Average Length of Stay, and the Cost of Care," *Journal of Health Economics* 4(4): 333-356.

[105] Salkever, D. (1978), "Competition among Hospitals," in W. Greenberg ed., *Competition in the Health Care Sector: Past, Present the Future* (Aspen Press).

[106] Satterthwaite, M. (1979), "Consumer Information, Equilibrium Industry Price and the Number of Sellers," *Bell Journal of Economics* 10(2): 483-502.

[107] * Shanghai Health Insurance Bureau (2002), "Collections of Official Documents on Health Insurance Policies (Yiliao Baoxian Zhengce Huibian)," http://www.shyb.gov.cn.

[108] Sloan, F. (2000), "Not-for-Profit Ownership and Hosptial Behavior," in A. Cuyler & J. Newhouse ed., *Handbook of Health Economics* (Elsevier North-Holland), Chapter 21.

[109] Sloan, F. & E. Becker (1984), "Cross-Subsidies and Payment for Hospital Care," *Journal of Health Politics, Policy & Law* 8(4): 660-685.

[110] * Sun, Q., R. Ge & Q. Meng (2005), "Cost and Efficiency of PET/CT," *Chinese Journal of Health Economics (Zhongguo Weisheng Jingji)* 2005(2): 37-41.

[111] * Tao, Y. Q. Cai & B. Ren (2004), "Barriers to the Development of Private Hospitals and Some Suggestions," *Chinese Journal of Current Hospital Administration (Zhongguo Xiandai Yiyuan Guanli)* 2(12): 35-37.

[112] Ulrich, V. & E. Wille (1996), "Healthcare Reform and Expenditure on Drugs: The German Situation," *Pharmacoeconomics* 10(Supp): 81-88.

[113] U.S. Genral Accounting Office (1991), "Health Care Spending Control: The Experience of France, Germany and Japan," Gaithersburg: U.S. General Accounting Office.

[114] Van Doorslaer, E., O. O'Donnell, R. Rannan-Eliya, A. Somanathan, S. Adhikari, C. Garg, D. Harbianto, A. Herrin, M. Huq, S. Ibragimova, A. Karan, T. Lee, G. Leung, R. Lu, C. Ng, B. Pande, R. Racelis, S. Tao, K. Tin, K. Tisayaticom, L. Trisnantoro, C. Vasavid & Y. Zhao (2007), "Catastrophic Payments for Health Care in Asia," *Health Economics* 16(11): 1159-1184.

[115] Van Doorslaer, E., O. O'Donnell, R. Rannan-Eliya, A. Somanathan, S. Adhikari, C. Garg, D. Harbianto, A. Herrin, M. Huq, S. Ibragimova, A. Karan, C. Ng, B. Pande, R. Racelis, S. Tao, K. Tin, K. Tisayaticom, L. Trisnantoro, C. Vasavid & Y. Zhao (2006), "Effect of Payments for Health Care on Poverty Estimates in 11 Countries in Asia: An Analysis of Household Survey Data," *Lancet* 384(9544): 1357-1364.

[116] Vella, F. & M. Verbeek (1999), "Estimating and Interpreting Models with Endogenous Treatment Effects," *Journal of Business & Economic Statistics* 17(4): 473-478.

[117] Van de Ven, W. (1995), "Regulated Competition in Health Care: With or Without a Global Budget?," *European Economic Review* 39(3/4): 786-794.

[118] Wagstaff, A., M. Lindelow, S. Wang & S. Zhang (2009a), "Reforming China's Rural Health System," World Bank Human Development Report.

[119] Wagstaff, A., W. Yip, M. Lindelow & W. Hsiao (2009b), "China's Health System and its Reform: A Review of Recent Studies," *Health Economics* 18(2): S7-S23.

[120] * Wang, B. & Y. Zhang (2002), "An Investigative Analysis of Six Private Hospitals," *Chinese Health Economics (Zhongguo Weisheng Jingji)* 21(1): 51-54.

[121] * Wang, S. (2003), "Crises and Opportunities for Public Health in China," *Comparative Studies (Bijiao)* 7.

[122] * Wenzhou Health Economics Association (Research Team) (2004), "A Study on the Tax Policies for the Profit Hospital," *Health Economics Research (Weisheng Jingji Yanjiu)* 2004(7): 31-33.

[123] Weisbrod, B. (1988), "The Nonprofit Economy," Harvard University Press.

[124] West, L. (1999), "Pension Reform in China: Preparing for the Future," *Journal of Development Studies*, 35(3): 153-183.

[125] Wolfe, P. & R. Moran (1993), "Ramsey Pricing and Supply-Side Incentives in Physician Markets," *Journal of Health Economics* 12(4): 365-384.

[126] Wooldridge, J. (2001), "Econometric Analysis of Cross Section and Panel Data," MIT Press.

[127] ——— (2003), "Cluster-Sample Methods in Applied Econometrics," *American Economic Review* 93(2): 133-138.

[128] ——— (2006), "Cluster-Sample Methods in Applied Econometrics: An Extended Analysis," Michigan State University Working Paper.

[129] World Health Organziation (2000), The World Health Report 2000: Health Systems: Improving Performance.

[130] World Bank (1992), "China: Long Term Issues and Options in the Health Care Transition," World Bank Country Report.

[131] ——— (1997), "Financing Health Care: Issues and Options for China," in "*China 2020*" series.

[132] ——— (2005), "Rural Health in China: Briefing Notes Series."

[133] * Wu, A., Y. Li, Y. Zhang & X. Cheng (2004), "DRG-based Payment Reform for Urban Health Insurance Scheme," *Chinese Journal of Health Economics (Zhongguo Weisheng Jingji)* 9:38-39.

[134] * Wu, R. (2001), "Establishing and Improving the Chinese Social Security System," *Chinese Health Care (Zhongguo Yiliao)* 2001(2): 9-11.

[135] * Xu, Z. (2002), "Social Health Insurance: Institutional Choice and Management Model (Shehui Yiliao Baoxian: Zhidu Xuanze Yu Guanli Moshi)," Social Science Archive Publishing House (Shehui Kexue Wenxian Chubanshe).

[136] Yatchew, A. (1997), "An Elementary Estimator of the Partial Linear Model," *Economics Letters* 57(2): 35-43.

[137] ——— (2003), "Semiparametric Regression for the Applied Econometrician," Cambridge University Press.

[138] You, X. & Y. Kobayashi (2009), "The New Cooperative Medical Scheme in China," *Health Policy* 91(1): 1-9.

[139] * Zheng, Q., Z. Wang & H. Yan (2003), "Investigation and Analysis about Village Doctors of 46 Poor Counties in Nine Provinces and Cities in Western China," *Chinese Journal of Public Health Management (Zhongguo Gonggong Weisheng Guanli)* 19(2): 175-176.

[140] * Zhenjiang Health Insurance Bureau (2000), "Lessons from Zhen Jiang's Reimbursement Methods on Health Insurance Expenditures," *Soft Science of Health (Weisheng Ruan Kexue)* 14(3): 103-104.

[141] * Zhenjiang Social Security Bureau (2000), "To Establish and Improve Control Measures on Health Expenditures; To Deepen the Reform of Employees' Basic Health Insurance System of China," *Soft Science of Health (Weisheng Ruan Kexue)* 14(3): 107-112.

[142] * Zhong, G. (2000), "Analysis of Market Competition in Health Care," *Health Economics Research (Weisheng Jingji Yanjiu)* 4: 13-15.

[143] * Zhu, W. (2005), "The Monopoly of Large Hospitals," *Sanlian Life Weekly (Sanlian Shenghuo Zhoukan)* Iss 349 (08-22-2005).

[144] Zuckerman, S. (1987), "Commercial Insurers and All Payer Regulation: Evidence on Hospitals' Responses to Financial Need," *Journal of Health Economics* 6(3): 165-187.

*Note: * indicates Chinese-language publications or presentations.*